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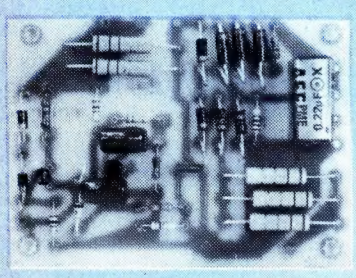
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Volume 45, No. 12, December 1983

On the cover

Featuring a 40-column by 8-line LCD, Tandy's new TRS-80 Model 100 is the first of a new breed of portable computers. It is significant not only for what it offers but also for the possibilities it foreshadows. Turn to page 92 for our in-depth review.

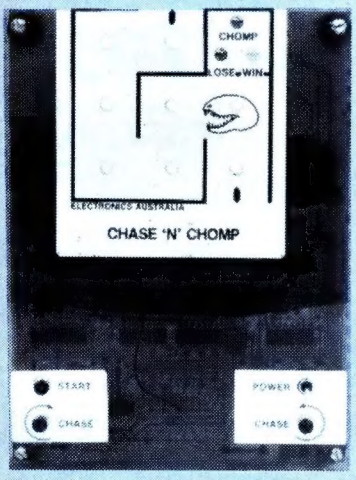


Electronic ignition

Want to convert your car to electronic ignition? This new circuit uses a Hall Effect device to replace the points in the distributor. It's easy to install, locks in engine tune, and is virtually maintenance free.

VK Powermate

Power your amateur rig from the mains with the VK Powermate. It provides 13.8V DC at up to 10A (intermittent) and features overvoltage protection. See page 62.



Chase 'N' Chomp

Chase 'N' Chomp is a hand-held gobble-em-up electronic game. It uses novel bi-colour LEDs, features simple sound effects, and can be difficult to play. Turn to page 52.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments

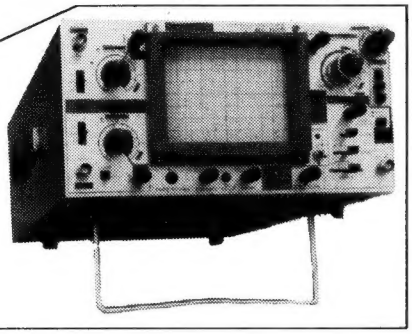
Betamovie

After months of speculation, the new "Betamovie" video camera/recorder has arrived. The system is revolutionary and could establish a whole new trend in home movie making. Our report starts on page 20.

FOR PERFORMANCE & VALUE AARON HAS TO BE YOUR FIRST SCOPE CHOICE

All these scopes are dual trace and incorporate the latest features such as high brightness rectangular CRTs.

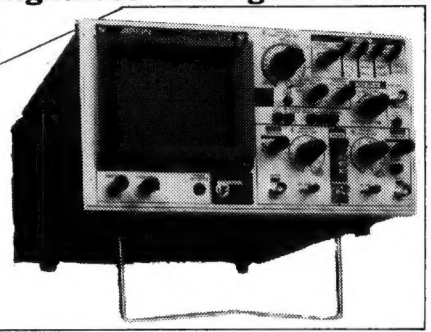
SIGNAL AND TIMEBASE DELAY



- 7.7nS risetime
- Single sweep
- Trigger delay
- TV sync
- X-Y, dual, chop, add, subtract etc.

45MHz/1mV
BS625 $1095

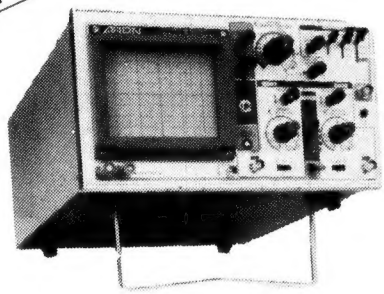
ALTERNATE AND DELAYED TIMEBASE



- 21 range timebase
- 100mS-1 μS trigger delay
- Front panel trace rotate
- X-Y, dual, chop, add, subtract etc

35MHz/1mV
BS635 $875

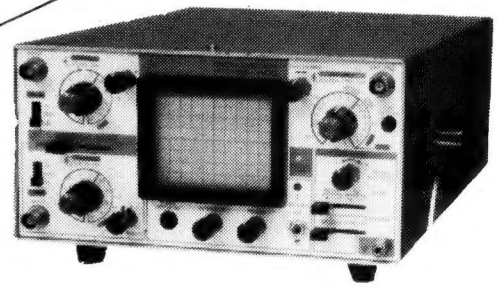
BUILT-IN COMPONENT TESTER



- Check components on screen
- 19 range timebase
- Triggerable to over 30MHz
- 17nS risetime

20MHz/5mV
BS601 $535

BATTERY PORTABLE



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MODEL	B'WIDTH	SENS	SIG DEL	TRIG DEL	SCREEN	T'BASE
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635	35MHz	1mV	N	Y	150mm	0.1μS 0.5S div
601	20MHz	5mV	N	N	150mm	0.5μS 0.5S div
310	15MHz	2mV	N	N	95mm	0.5μS 0.5S div

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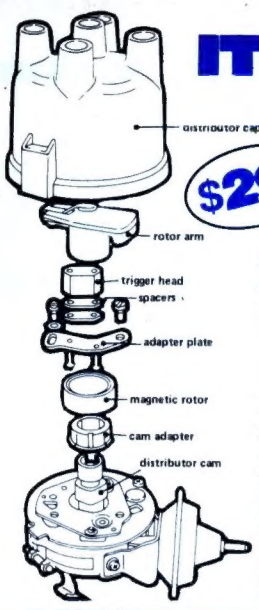
IT HAD TO HAPPEN



$29.95

PLEASE NOTE
this system must be used in conjunction with an electronic ignition. The Hall Effect device will not switch enough current to replace the contact breaker points on their own!

With this kit and the interface electronics you can forget about contact breaker point problems!
Cat. KJ-6655 $29.95

New PCB for TAI Kit includes Hall Effect interface. Cat. HP-8786 ONLY $3.95

A professionally engineered electronic ("breakerless") contact breaker system.
Yes, only Jaycar has a complete Hall-effect triggerhead assembly designed to adapt to an extensive number of cars. Each kit contains the following:
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  OVER 6 CAM LOBE ADAPTORS
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- AS EASY TO INSTALL AS A SET OF POINTS!
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This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.
Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts that you don't need to use! (Perhaps for your next car?)
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Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOR EVER.
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Jaycar and Electronic Agencies have the largest range of kits in Australia. We stock kits for most of the projects described by the magazines over the last few years. Space does not permit us to include ALL kits in our ads, all the time. So if you are after a specific kit – call us first.
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Ref: ETI Feb 1982
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The KA1522 Breath Tester can help here. A unit with the same circuit diagram was featured in May "Electronics Australia". It CANNOT give you an actual blood/alcohol content reading, however it can go close. And it can give you a relative reading between inebriated friends!!! Great at parties!!!
Grab the whole kit now for only $29.95. You never know, it may save your licence or your life!

Cat. KA1522

VIDEO ENHANCER

Ref: EA Oct 1983
Get improved performance from your VCR.
Cat. KE-7016 $35.00

ONLY $35

TRANSISTOR TESTER KIT

Check your transistors in circuit. Saves removing them. Ref: EA sept. 1983.
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Ref: EA Nov. 1983
Great new version of this handy piece of test gear. Now you can generate Crosshatch, Dots and Blank (white) video signals. This is handy for TV/Video alignment.
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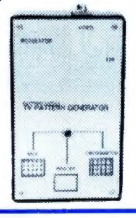

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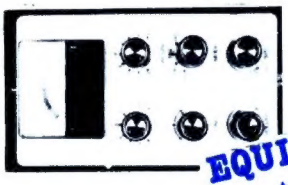
SEE ETI DEC 1980 and JAN/FEB 1981



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Ref: EA April 1983
Cat. KA-1508

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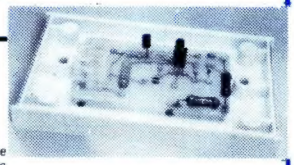

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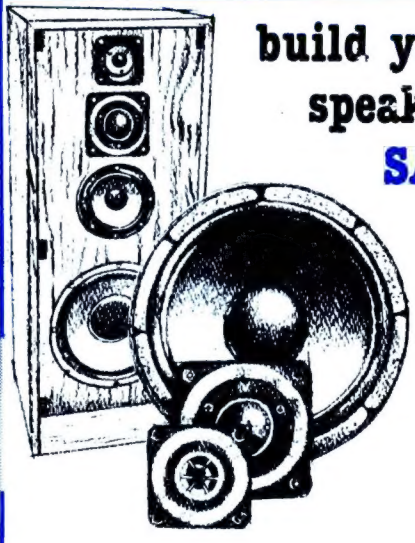

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HOME VIDEO CAMERAS

First discover the facts—then learn by doing

We can't make you an instant expert in video photography; only hands-on experience can do that. But we can put you into the picture by discussing video cameras generally and examining in detail a typical current model. In a follow-up feature, we take a close look at the new, trend-setting "Betamovie" combination camera/recorder.

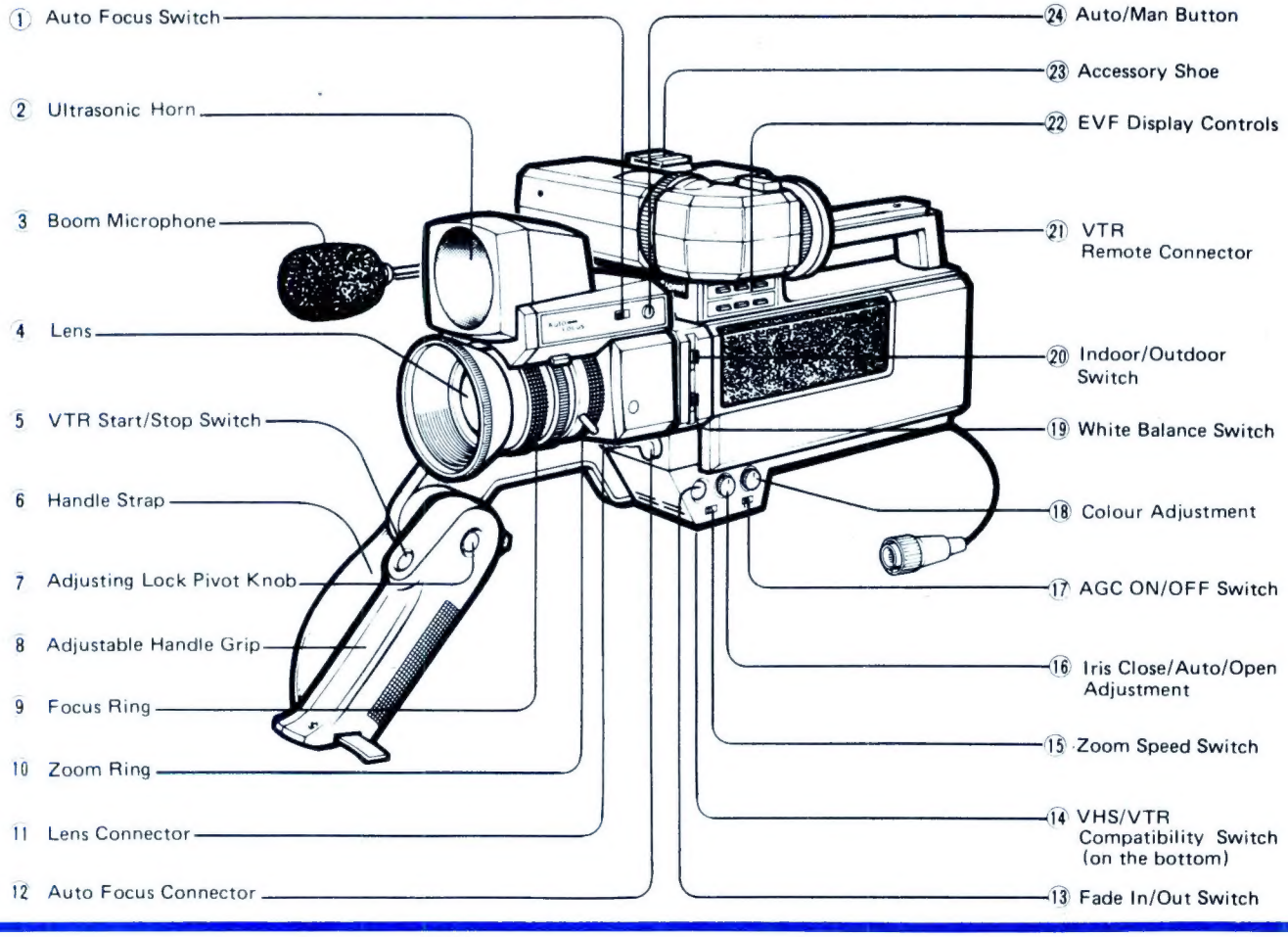
Until a few years ago, home video cameras were few and far between. They were relatively expensive and predominantly monochrome, with very limited appeal in a world of colour films and colour television. Many of them ended up being used for surveillance rather than entertainment.

But, with the '80s, came a veritable explosion in world sales of VCRs (video cassette recorders) and that, in turn, produced a keen demand for video cameras to use with them – hopefully compatible in terms of sound, colour, resolution and price. The challenge was quickly taken up.

Currently, most VCR manufacturers either supply or recommend suitable domestic video cameras which meet those criteria, while many also offer portable VCRs intended for on-the-move, outdoor video photography. The proportion of VCR owners with a video camera is still quite modest but, even so, video camera users are becoming a familiar sight at outings and holiday resorts.

Their number would probably be higher if it were not for the fact that many still regard a video camera as a rather daunting and mysterious piece of equipment. In fact, it need not be so for

MAJOR OPERATING CONTROLS AND THEIR FUNCTIONS



From the National range, the popular WVP-100N video camera features automatic control of focus, iris, white balance, and gain for video and audio.

anyone versed in film photography, or with even modest practical skills.

The newcomer obviously needs to study the manual(s) for the selected equipment and to observe a few basic rules about lighting, moving picture photography and sound recording. But, from then on, it's largely a matter of learning by doing. The great advantage of video photography is that one can practice for hours on end, with all manner of subjects, without wasting film and at virtually no extra cost.

But let's look at the actual equipment.

Virtually all present-day home video cameras depend for their operation on a miniature evacuated camera tube, identified by a variety of copyright trade names but essentially a descendant of the original Vidicon, first used in the '50s. Even the very latest Sony/Sanyo/Toshiba "Betamovie" uses an "SMF Trinicon" tube, while the National WVP-100N, mentioned later, features a "Saticon".

Concerted efforts are being made throughout the industry to develop a solid state equivalent – eg a CCD or "charge coupled device" – but with only limited success so far. When they do become fully competitive, as they inevitably will, they should offer a significant advantage in terms of space, weight and current drain.

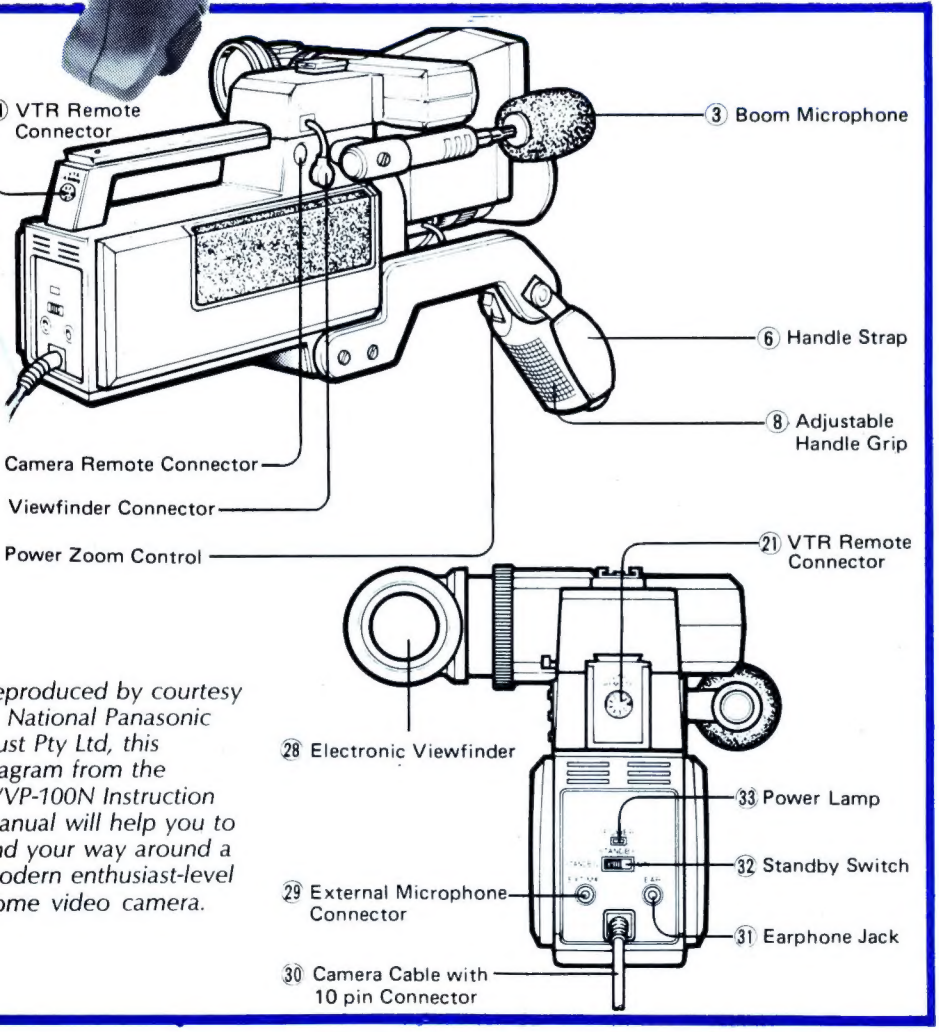
In the meantime, camera tubes themselves are being progressively refined, with smaller dimensions for a given order of resolution, reduced "drag" with bright moving objects, improved colour rendition, and higher effective sensitivity.

A couple of years back, manufacturers were happy enough to quote a minimum illumination figure of 100 lux (10 foot candles) equivalent to a room with fairly subdued lighting. One half or even one third of that minimum figure is now fairly commonplace and, while video photography at such light levels may not be the best, occasions can arise when the extra sensitivity would make the difference between a picture or no picture.

The camera tubes in current models typically have an image electrode or "target", on which the desired scene is focused, with a nominal diameter of between 12 and 17mm – a startlingly small figure when it is realised that the tiny image may ultimately be viewed on a screen having an equivalent corner-to-corner "diameter" of at least 63cm.

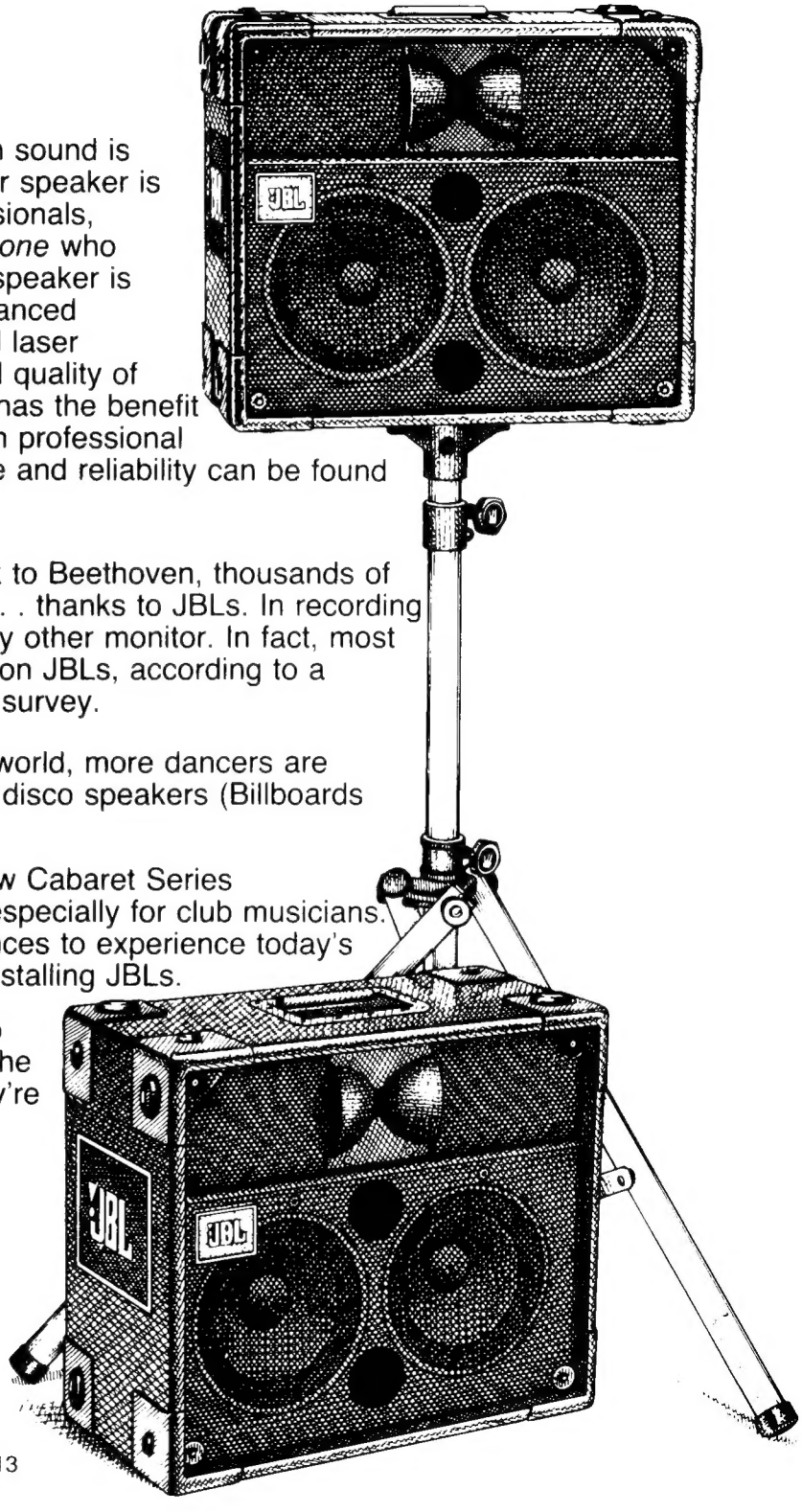
Even so, with a resolution rating of 300 lines in the centre of the picture, the detail available from a modern home video camera compares favourably with that from typical VCRs and, for that matter, from a fair proportion of the film prints broadcast by TV stations.

The optical system required to capture and focus the image is reminiscent of what is commonly found in an enthusiast-level 35mm film camera or a home movie camera. The same expressions appear in the literature: lens mounting, aperture, focal length, focus system; zoom and macro facilities; illumination requirements, colour temperature, filter diameter, and so on.



eproduced by courtesy National Panasonic ust Pty Ltd, this agram from the VP-100N Instruction anual will help you to nd your way around a odern enthusiast-level ome video camera.

JBL — WHERE THE MUSIC HAPPENS



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And serious musician/songwriters who rely on home recording are following the lead of the big recording studios: They're turning to JBLs, too.
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HOME-VIDEO CAMERAS

To many photographic enthusiasts, this will have a familiar ring, as will the list of optional extras available for the more pretentious models: large ratio zoom, supplementary lenses, filter kit, film/slide copy adaptor, remote controls, tripod, etc – gadgets for the enthusiast to delight in, pay for and carry around!

Budget model home video cameras are most commonly provided with a TTL (through the lens) or other optical viewfinder, with appropriate provision for manual focusing, as in a normal film camera. However, while an optical viewfinder does show the scene in natural colour, it gives no clue to the operator as to the quality of the actual video image being generated and recorded.

In consequence, video cameras in the middle to upper price range now almost invariably offer an electronic viewfinder involving a miniature monochrome picture tube (30mm diag. approx) mounted behind a lift-up eyepiece. This gives the user the option of inspecting the image through a lens or viewing it directly from a few centimetres further back.

While a colour presentation might be seen as the ultimate objective – but a difficult one to achieve at this stage – a high definition monochrome image does permit critical examination of the luminance structure of the picture in terms of focus and focal range, composition, general lighting, highlights, shadows and contrast range. In practical terms, a well set up monochrome image in the viewfinder provides a fairly solid guarantee of a satisfying colour picture on the TV screen.

An electronic viewfinder has the important advantage that, without too much extra complication, it can be used to provide instant, on-the-spot replay of tape that has just been recorded. A video photographer can therefore check on what he/she has taken before packing up and moving off to the next point of interest.

No less importantly, the tape can be reset to a particular point, in preparation for the next shot, as an aid to good presentation of successive scenes – in short, for on-the-spot "assembly" or "serial" editing.

In an advanced design, an electronic viewfinder can also carry graphics to indicate to the user the status of the camera or VCR – in lieu of the more usual array of coloured LEDs. Graphics such as date and time may even be displayed for ultimate inclusion in the video image.

Accessories to quicken the pulse of any video enthusiast. At top left is a film/slide copying lens, complete with holders (below). At top centre is a 12X power zoom and, immediately below it, a 1.5X tele converter lens. At the top right is an extension lead for remote camera control and viewfinder. Below it is a filter kit for novel optical effects. At the bottom left is an on-camera remote control unit for the associated VCR.

During the past year or so, a number of home video cameras have appeared on the market featuring fully automatic focus, involving either infrared or ultrasonic technology. Both methods work well in the majority of situations and it is a real boon to be able to forget focus and be free to concentrate on other things. The automatic function can be disabled to cope with special requirements or to conserve battery power when the focus can be left set for long periods.

To scan the scene on the target electrode of the camera tube, all home video cameras, these days, have their own in-built field and line timebase circuits, which deflect the scanning beam within the camera tube and ultimately provide standard field and line synchronising pulses for the associated equipment: VCR, monitor, receiver, etc.

The provision of reliable time base/scanning/sync circuitry in any form posed a major problem in the valve era, and remained a difficult one, even with discrete transistors. The development of suitable special-purpose ICs has made all the difference in terms of cost, compactness, reliability and economy of current drain.

Much the same observation applies to the highly complex circuitry which is necessary to process the pulses from the camera tube into orderly luminance and chrominance information and to assemble it, along with the synchronising pulses, into a standard PAL format video signal.

In the process, the video circuitry reacts to the incoming light level and opens or closes the iris diaphragm in the lens system accordingly. It monitors and controls the video signal levels and facilitates compensation for the colour temperature of the light. Some cameras provide supplementary user controls for hi/lo light levels, indoor/outdoor shooting, incident or back lighting, etc, but control of the video signal is, for the most part, automatic.

In fact with automatic focus, white balance, iris and exposure control, and automatic level control for the microphone, some cameras are getting quite close to the stage where they can operate on a "point-and-shoot" basis.

The sound pick up provision in a home video camera is normally fairly basic and distinct from the video circuitry. It usually involves a directional electret microphone, mounted in the front of the camera body, or on a short telescopic support which extends to about level with the front of the lens.

A microphone attached to the camera is fair enough for recording incidental environmental sound but leaves much to be desired for recording voices to match anything but a close-up shot. For this reason, many cameras also have provision to plug in an external

microphone, which can be positioned closer to the source of the sound.

Home video cameras normally require an external power supply source, typically 12V DC at around 0.5A for normal operation and somewhat less in standby modes, where such apply.

With a portable video system, the camera normally picks up its supply from within the VCR, via the same multi-lead cable and plug which carries the video, audio and control circuitry. The system as a whole may then typically operate from a rechargeable battery pack, from a 12V DC car or boat electrical system, from an in-built AC power supply, or from a separate AC mains supply/charger unit.

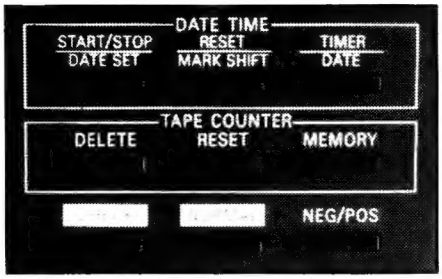
A few mains-powered domestic VCRs also provide for a camera with a multi-pin socket and internal power supply, but most simply have "Camera Input" and "Camera Remote" sockets for video in and remote pause control, plus a Camera/Tuner selector switch. In such cases it is normally necessary to purchase a matching external camera supply/adaptor, which plugs into the mains and operates between the camera and the VCR.

In practice, a video camera coupled to a non-portable domestic VCR is rather limited in its uses, even when an extension camera cable can be provided. It makes good sense, in such a case, to choose a fairly simple, inexpensive model.

For portable or on-the-move video photography, the considerations are much the same as for film photography. Some will prefer a simple, uncomplicated camera, for minimum hassle, even though it may impose a few compromises. Many, however, tend to take the reverse view on the grounds that, if they are going to take up video photography, they may as well do it properly!

But, whatever your ideas in this respect, check carefully through the available range of cameras. Note whether the facilities they offer match your needs, and whether the user manual adequately explains those facilities. If a particular model appeals to you, hold it in the taking position for 10 minutes while you are talking and note whether it is beginning to feel heavy and awkward. Make sure the viewfinder is right for your good eye, and so on.

And, last but not least, favour a model which carries the same brand name as your VCR, or is specifically recommended by a manufacturer as being fully compatible. One of the most frequent complaints heard in the industry is from enthusiasts who have tried to use this camera with that VCR, on the vague assumption that "she'll be right mate". The problem is that, when a discrepancy



Controls for the viewfinder and on-screen display, reminiscent of VCR programming.

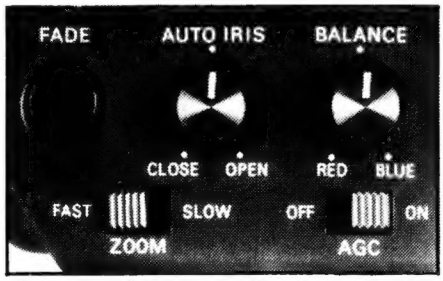
is enountered, it is difficult to find anyone in a position to identify it readily and correct it.

Against this general background, we suggest you spend a while studying the diagrams herewith of a typical modern home video camera – the National WVP-100N. We selected it because it has proved a "best seller" since its release earlier this year and it is well endowed with features to illustrate what we have been talking about.

We suggest you break off here, for a few minutes, to study the accompanying diagrams, as a substitute for being able to handle the real thing.

In the Instruction Manual, each point is keyed by the numbers to an explanatory paragraph but it is not practical to reproduce it all here. However, a few points warrant special comment:

The ultrasonic transmitter/receptor for auto focus is shown at (2). It can be disabled by switch (1) but even in the manual position, the lens can be refocussed quickly and automatically by briefly pressing button (24). Most auto focus systems have this handy feature,



A group of picture-taking controls. The Iris knob allows compensation for very light or dark backgrounds.

On the rear of the camera, the Standby switch and provision for external mic and monitoring earphone.

which helps conserve battery power in the field.

The lens (4) is a 6:1 power zoom (12.5mm to 75mm at F1:4) which is typical of current model home video cameras. The two-speed zoom (six secs and 10 secs) is a refinement, as also is the provision for interchanging lenses and the use of special effects filters, tele conversion lens and film/slide copier, as illustrated.

In addition to providing automatic edit – an instantaneous noise-free change from scene to scene – switch (13) produces a smooth fade out/fade in transition between scenes for both video and audio. It is a pleasant alternative but one that should be used sparingly. Overdone, it can become as tedious as too frequent use of the zoom.

Switch (20) presets the camera colour circuitry to suit ambient light temperatures of 3200°K for typical indoor photography or 5500°K for outdoor shots. Any further correction for colour balance is performed automatically by operating switch (19).

The EVF (electronic view finder) controls can be used rather like the time set controls in a VCR to set the date and a stopwatch timing function in minutes (up to 60), seconds and tenths of a second. These can be superimposed on the tape image, for noting lap times, etc. A dozen or so cues (displayed but not recorded) have to do with the status of the system: eg battery condition, light level, white balance, auto focus off-on, etc.

Socket (21) provides a connection for the on-camera VCR remote control unit, which slides into position on top of the handle.

Sockets (25) and (26) accommodate the extension lead for remote control of the camera and remote viewfinder – good for special situations like bird photography, where the operator needs to remain out of sight.

At one stage, we had it in mind to round off this article with a full review of the WVP-100N camera but we simply ran out of time and space. To review a camera properly, one really needs to use it in a variety of planned situations, under a variety of lighting conditions, not only to see how it performs, but how acceptable it is in terms of handling and control.

The best we could do at the time was to use it around the home, taking shots of shrubs and spring flowers, zooming in on individual blooms, and cutting to whatever else offered – garden birds, low-flying planes, passing cars, pedestrians and their pets!

The automatic focus and power zoom handled all this without the slightest

Continued on p.23

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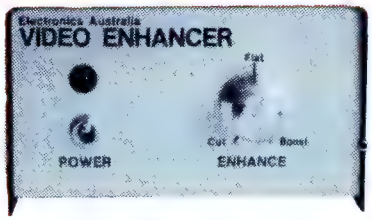


Like tone controls in a hifi amplifier, touch up the signal with this Video Enhancer. **EA OCTOBER 83**

NAIL FINDER $10

Essential for the home handyman the Nail Finder will help locate timber studs behind Gyprock or plasterboard wall surfaces as well as locating pipes and wiring buried in walls.

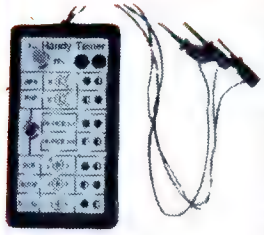
EA OCTOBER 83

SPEED SENTRY $11

EA OCTOBER 83

Paying speeding fines can be a painful business. Build this Speed Sentry and avoid further pains in the wallet.

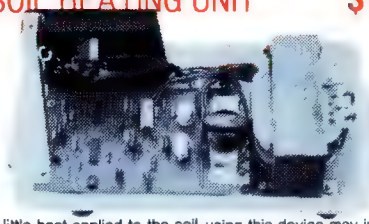
TRANSISTOR TESTER $15



Have you ever desoldered a suspect transistor, only to find that it checks OK? Troubleshooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester such as the EA Handy Tester.

EA SEPTEMBER 83

SOIL HEATING UNIT $70



A little heat applied to the soil using this device may just do the trick. **EA SEPT 83**

WATTMETER $65

The unit described here will measure the power consumption of any mains appliance with a rating up to three kilowatts. It makes use of a special op amp called an "output transconductance amplifier" or OTA, for short.

EA SEPTEMBER 83

CAR ALARM

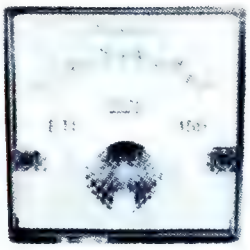
$29.00

This Car Alarm uses the battery earth strap as a sensor to detect when a "courtesy" light or other electrical load occurs when a thief enters a vehicle. The circuitry is simple and immune from false triggering problems. **ETI July 81**

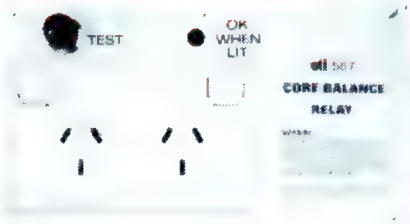
10-15V EXPANDED SCALE V-METER

ETI 159 December 81

$26.50



CORE BALANCE RELAY ETI 567



$44.50

Mains-operated equipment that goes faulty is potentially lethal. Electro-mechanical "core-balance relays" which sense earth-fault currents and trip a circuit breaker have been available for house-mains installation for some years. Portable core-balance relay units have obvious advantages. Protect yourself — and your equipment — with this simple, inexpensive project.

VIDEO AMPLIFIER $15

EA AUG 83

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead. It's much better.

The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugpack supply.

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EA July 1983

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FRIDGE DOOR ALARM

When the refrigerator door has been left open for about 20 seconds — or, more correctly, when the light has been on for 20 seconds — this EA Fridge Alarm will emit a series of reminder beeps until the culprit closes the door.

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FOR PCB VERSION

EA July 1983

Portable 3½ Digit Heart Rate Monitor

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Here is a new heart rate monitor designed specifically for use by the dedicated fitness seeker. Small enough to carry when jogging or exercising, it features an optical sensor, no electrical connections to the body, an in-built calibration circuit, and direct readout on a large liquid crystal display (LCD).

Driveway Sentry

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Activated by your car's headlights, the "Driveway Sentry" will turn on a driveway or garage light so that you can make a safe exit from your car on the darkest of nights. At the end of five minutes, it will automatically turn the light off again.

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BETAMOVIE *Will this revolutionar*

After months of speculation, the new "Betamovie" combination video camera/recorder was unveiled recently at Sydney's Regent Hotel. We were able to inspect it, handle it and also to learn something of its basic technology from an engineering paper made available to us by the Consumer Video Division of the Sony corporation.

While developmental single-unit camera/recorders have been talked about for some time, Betamovie is the first such unit to be released commercially to home video buyers. It went on sale in Japan and the USA in May, and is scheduled for release in Australia in the CCIR (PAL) format during the current month.

The function in Sydney was jointly

by NEVILLE WILLIAMS

Dimensions of the Betamovie are quoted as 125(W) x 220(H) x 357(D)mm and the weight as 2.48kg without battery in the handle.

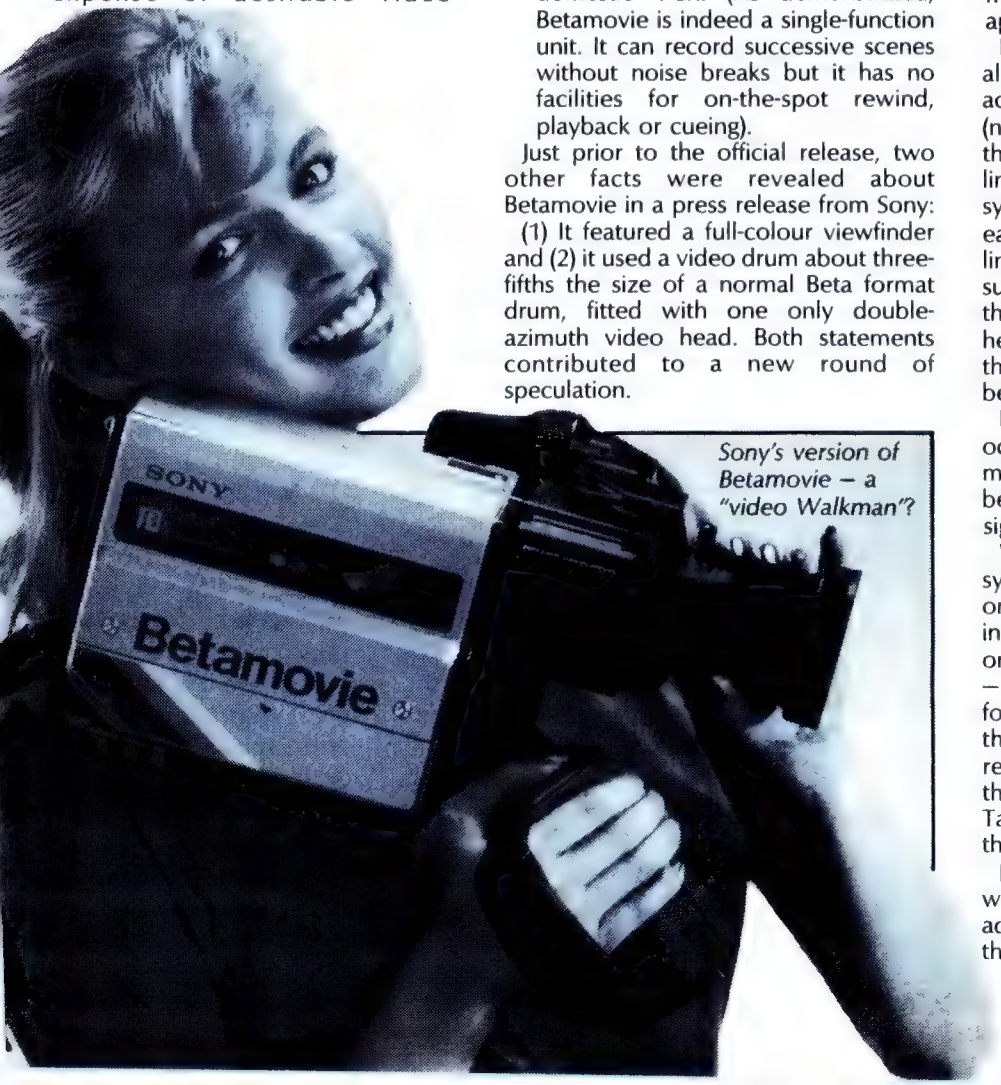
me video camera/recorder establish a new trend?

sponsored by Sony, Sanyo and Toshiba, indicating that all three companies see Betamovie as a significant breakthrough and an opportunity to advance the claims of the Beta system as a whole.

While the occasion provided an opportunity for many of those present to see and handle the new camera/recorder for the first time, the actual announcement surprised no one. Over the past year or so, technical journalists around the world have been able to piece together the basic concept of Betamovie from a variety of sources. They already knew that:

- It would be a single-unit video camera/recorder, comparable in size and weight to existing high-performance, conventional home video cameras. (At 2.48kg without battery, Betamovie does indeed invite comparison with the WVP-100N discussed elsewhere but, at the same time, it gains portability at the expense of desirable video production facilities).
- It would be completely self-contained and capable of immediate use without external cables or attachments. (It certainly can function independently but provision has also been made to operate it in conjunction with an AC mains adapter, a car battery cord, a high capacity battery belt and an external microphone).
- It would use standard Beta cassettes and signal format and offer a maximum recording time of 215 minutes from an L-830. (It does, although the recording time from a single battery in the handle is limited to about 60 minutes. Beyond that, as with other portable systems, re-charging, or a back-up battery or other supply is necessary).
- It would perform recording only. For playback, the cassette would have to be plugged into a normal Beta domestic VCR. (As demonstrated, Betamovie is indeed a single-function unit. It can record successive scenes without noise breaks but it has no facilities for on-the-spot rewind, playback or cueing).

Just prior to the official release, two other facts were revealed about Betamovie in a press release from Sony: (1) It featured a full-colour viewfinder and (2) it used a video drum about three-fifths the size of a normal Beta format drum, fitted with one only double-azimuth video head. Both statements contributed to a new round of speculation.



Sony's version of Betamovie – a "video Walkman"?

Would the said viewfinder be an electronic type, involving a miniature, high-definition colour picture tube? If so, it would be a breakthrough indeed. In fact, the viewfinder turned out to be a normal optical TTL (through the lens) system, possibly influenced by a consideration that became apparent later.

However, what proved really intriguing was talk of a smaller diameter video drum and a single video head – particularly in view of statements that Betamovie provided a completely standard Beta format signal on the tape. It seemed almost like a self-contradiction and, at the time, Sony executives in Australia appeared to be as much in the dark as we were as to how it had been accomplished.

In all domestic VCRs, to date – Philips, Beta, VHS – the tape has been wrapped obliquely more than half-way round a rotating drum or plate carrying two (or more) record/playback heads, set 180° apart. (See Fig. 1).

In the Record mode, the heads write alternate magnetic tracks obliquely across the tape, each track containing (nominally) the total information from the respective odd and even fields: 262.5 lines per field in the case of the NTSC system, and 312.5 for CCIR/PAL. In fact, each head remains active for a few extra lines, providing a deliberate overlap, such that line information just ahead of the vertical sync block is fed to both heads and recorded simultaneously – at the end of each field scan and the beginning of the next.

During playback, head switching occurs during this overlap period, minimising the risk of the video system being left even momentarily without signal due to a timing error.

When trying to envisage a single head system, an obvious difficulty is that no one head, or dual head structure, can be in two places at once – at the finish of one helical scan and the start of the next – let alone provide the overlap required for a standard Beta signal format. Hence the apparent contradiction, which remained unresolved until we sighted the design paper by Seiji Sato, Koichi Takeuchi and Masanobu Yoshida, from the Consumer Video Division of Sony.

In their paper, the three authors begin with the assumption that, to take advantage of the already modest size of the standard Beta cassette, it was

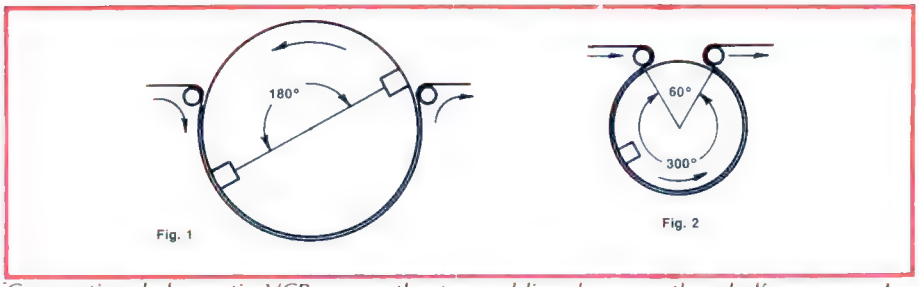
BETAMOVIE

essential to simplify and reduce the overall dimensions of the tape traverse mechanism, beginning with the video drum itself. The whole Betamovie concept really depended on that proposition and it therefore became the starting point for the new design.

Since the length of the helical scan had to conform to the existing standard, the drum size could certainly not be reduced by more than 2:1. But that would not be practical, anyway, because the need for tape feed and take-up guides must limit the tape wrap to less than 360°. To accommodate the necessary wrap length, the new drum would therefore have to be more than half-size.

Calculations suggested that the best mechanical compromise would be a drum circumference (therefore diameter) of about three-fifths of normal, with an active recording/playback traverse of 300° and with the feed and take-up guides located within the remaining 60°. (See Fig. 2).

But that led to the natural and awkward question: how to cope with the 60° gap and the time interval when the head is not even in contact with the tape? How could the video signal possibly be continuous in those circumstances?



Conventional domestic VCRs wrap the tape obliquely more than half-way round a rotating drum carrying two record/playback heads set 180° apart (Fig. 1). To reduce the size of the tape transport, Betamovie uses a smaller drum with an active record/playback traverse of 300° (Fig. 2).

Without seeking to explore all the detail set out in the design study, the method which was devised to get around that formidable problem can be summarised as follows:

INCREASE THE LINE RATE: Leaving the frequency of the vertical timebase unchanged, increase that of the line oscillator by a factor of 360/300 (1.2 times). For the NTSC system, this results in 60 fields, each of 315 lines; for the CCIR system, the figures become 50 fields, each of 375 lines.

OVERSCAN THE WANTED IMAGE: Arrange for the camera tube to overscan vertically by the same ratio (1.2 times), such that the number of scanning lines actually involved in the presentation of the wanted scene remains at (nominally) 262.5 per field for NTSC and 312.5 per field for CCIR.

SELECT THE VIDEO DRUM DIAMETER: The video drum spins at 60 or 50 rev/sec, being locked to the field frequency of the particular system. However, the diameter (therefore circumference) of the drum is selected such that the head writes a full-length Beta format track across the tape during the 300° sector. This represents 300/360 or 83% of the vertical scan period and the time required to record just the appropriate number of lines for the respective systems (nominally 262.5 for NTSC, 312.5 for CCIR).

SET THE TIMING: Arrange the timing so that the group of lines retained from each field are those actually involved in the presentation of the wanted scene, as depicted in the viewfinder. The 17% of

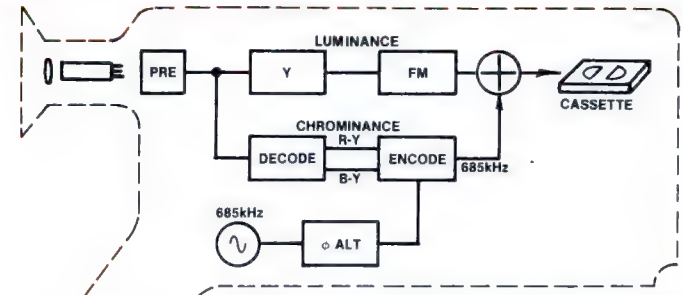


Fig. 3

Betamovie does not produce a standard composite video signal. Luminance, chroma and sync information follow separate paths until brought together for recording. (Diagram adapted from Sony paper.)

lines lost during the 60° sector are the overscan lines, not required anyway.

Implicit in the foregoing paragraphs are a number of interdependent calculations involving the precise drum diameter (therefore its peripheral speed relative to the moving tape), the required drum inclination relative to the tape path, the modifying effect of the foreshortened writing period, the head gaps, &c – all essential to ensure that the track as recorded conforms to the system standard.

Just to make things more difficult for themselves, the engineers responsible sought (successfully) a set of figures which would allow them to use the same mechanical components for the NTSC and CCIR version.

Allowing for a few difficulties in Japanese/English expression, the paper by Sato, Takeuchi and Yoshida explains and presents the mathematics behind the foregoing summary and proceeds to further observations about the signal itself.

They point out that, when multiplied by 1.2, the number of lines per frame becomes even and the fields lose the half-line relationship appropriate for an interlaced system. However, the physical distance between the two gaps in the double azimuth head creates a 1.5-line displacement between the alternate fields, anyway, and this can be juggled to the appropriate inter-field relationship by the use of a suitable delay line.

This done, they say, head replacement becomes a relatively simple matter, without the need to adjust two heads critically, relative to each other, on opposite sides of a conventional drum.

They also point out that the amount of signal processing required in a combination camera/recorder is much less than in two separate units: video camera and VCR.

In the latter case, filter and mixer circuits are required in the camera, in order to bring the luminance, chrominance and sync signals together into a composite output signal in the standard NTSC or CCIR format. Yet, in the VCR, the composite video signal has to be taken apart again, involving the use of comb, low-pass and band-pass filters, plus a delay line, before being modulated on to carriers for recording.

In Betamovie, the need for double, complementary processing is obviated. Luminance and chrominance signals from the camera section, plus sync information can follow separate paths along internal wiring before being finally brought together for recording – a rationalisation that must confer its own advantages. (See Fig. 3).

Against this, however, is the fact that, nowhere inside Betamovie does there exist a standard NTSC (or CCIR) video signal. The scanning circuits operate at line frequencies 1.2 times normal, there is 17% vertical overscan beyond the picture limits and at no stage are the components brought together into a standard composite signal. Only when the cassette is replayed on an entirely separate VCR does a standard NTSC or CCIR signal become available.

This being the case, Betamovie is basically unsuitable for use with any kind of monitor and, as mentioned earlier, it is probably a contributory reason why the designers decided to opt for an optical viewfinder.

But that is, perhaps, beside the point. Betamovie does not pretend to be a general-purpose camera. It has been designed for those who profess not to like general-purpose cameras, with their trailing cables and plugs and gadgetry. They claim to want something that they can simply pick up and point and shoot.

Well, here it is, needing only a Beta VCR, ready and waiting at home, and a spare 2000-odd dollars in your cheque account.

If you fall into that category, Sony, Sanyo or Toshiba would be delighted to hear from you. What's more, you can be quite sure that the other manufacturers will be watching with keen interest also, to see whether Betamovie does look like establishing a new trend!

HOME-VIDEO CAMERAS

Continued from page 16

problem. In fact, it was quite fascinating to note how the auto focus sensed quite accurately a subject as insubstantial as the foliage of a young flowering tea tree – or should we call it a Leptospermum Lambethi? Nor did it find any problem with speeding cars: approaching, passing and disappearing into the distance.

One of the benefits of working around the home like this is that one can take the cassette inside and replay it on the spot, without having to rely on a fading memory of the original hues.

Under normal blue sky/daylight conditions, and using the auto white balance as per instructions, the colours came up subjectively very close to the original but, with heavy cloud cover, we found it necessary to set the colour balance knob halfway towards "Blue" to keep the whites white and the greens green.

If we had a criticism of the otherwise well set out "Operating Instructions" manual, it would be that it is notably unhelpful in explaining how to cope with likely variations in daylight colour temperature.

One observation is that, while the auto focus works very well, it keeps right on working while ever it and the camera is left switched on, pictures or no pictures. If the system is operating from an external supply, it would not matter but, for long sessions on the move, it would be essential to conserve battery power by avoiding over-use of the auto focus and power zoom and by switching the camera to standby whenever possible.

We did not actually use the date and timing functions in the practical sense, although we brought them up on the screen to judge their clarity. It is sufficient to say that the on-screen figures are very distinct and clean and the stop watch is quite as professional as you've seen off-air timing major sporting events.

What we did sense was that, after a couple of hours use, the normal shooting routines were becoming quite automatic and one-handed, with the rear of the camera resting on the shoulder. That leaves the other hand free to operate supplementary functions or to provide occasional additional support.

On the assumption that it would do equally as well the things we hadn't tried, we could readily understand why the WVP-100N has become a popular choice by video enthusiasts and a "best seller" for National, despite its "going" price, quoted to us as "around $1399".

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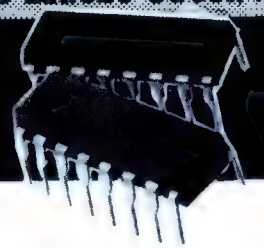

MICROPROCESSORS

The F9445 is a 16-bit microprocessor implemented using Fairchild's Isoplanar Integrated Injection Logic technology. This bipolar technology and a sophisticated pipeline architecture combine to give the F9445 very fast execution times. The processor has eight program-accessible registers and the capability of directly addressing 128K bytes (64K words) of memory. Up to 4M bytes of physical memory may be accessed using the F9444 memory management unit. The F9445 can address 62 I/O devices, handle 16 levels of priority interrupt, and perform fast direct memory access. It has control lines to provide operator-console functions and has an on-chip self-test program.

The F6800 is a monolithic 8-bit microprocessing unit (MPU) forming the central control function for the Fairchild F6800 family. Compatible with TTL, the F6800, as with all F6800 system parts, require only one +5.0 V power supply and no external TTL devices for bus interface. The F6800 is capable of addressing 65K bytes of memory with its 16-bit address lines. The 8-bit data bus is bidirectional as well as 3-state, making direct memory addressing and multiprocessing applications realizable.

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F68A40	6.78	4.88
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F68A52	3.11	2.60
F68A54	9.07	7.05
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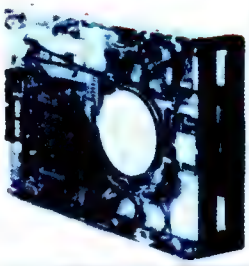

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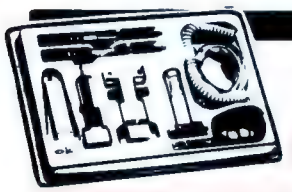

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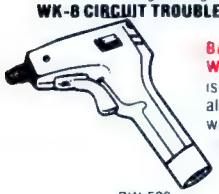

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Across the Pacific by helicopter

—a hazardous shipboard landing

by DON RICHARDS

A hazardous shipboard landing formed part of Dick Smith's recent around the world solo flight in a helicopter. This is the story of that landing.

On July 22, 1983, Dick Smith landed at Fort Worth, Texas, 50 years to the day after Wiley Post arrived back in the USA to complete the first ever solo flight around the world in a fixed wing aircraft. Dick's landing marked the first ever around the world solo flight in a rotary wing aircraft (or helicopter).

In planning his round the world solo flight, Dick Smith had two main aims: first, to prove that despite the existence of fast commercial airliners there are still worthwhile aviation pioneering goals to be achieved; and second, to demonstrate the range, versatility and dependability of the modern helicopter.

The world circumnavigation was accomplished in three stages. Starting in Fort Worth, Texas, Dick crossed the Atlantic to London in the spring of 1982. The second stage, London to Sydney, was completed later that year. The last stage was set for the Northern Hemisphere summer of this year and Dick sought landing rights for refuelling in many countries: Indonesia, the Philippines, Japan, the USSR, Canada and the USA. Permission to land was granted in all cases except for the USSR. Not only was permission refused, but Dick was warned that infringement of the sensitive boundary zone between the USSR and Japan could mean being shot down without warning.

The subsequent downing of the Korean jetliner by Soviet fighters during September illustrates that last point all too graphically!

The problem was that unless a refuelling stop could be arranged between the northern tip of Japan and the American base at the western end of the Aleutians, Dick could forget about his ambition to circumnavigate the globe. The distance, over 1400 nautical miles, was beyond the range of his modified Bell Jet Ranger. The distance is, in fact, greater than that between Australia and New Zealand — imagine flying that in a tiny helicopter!

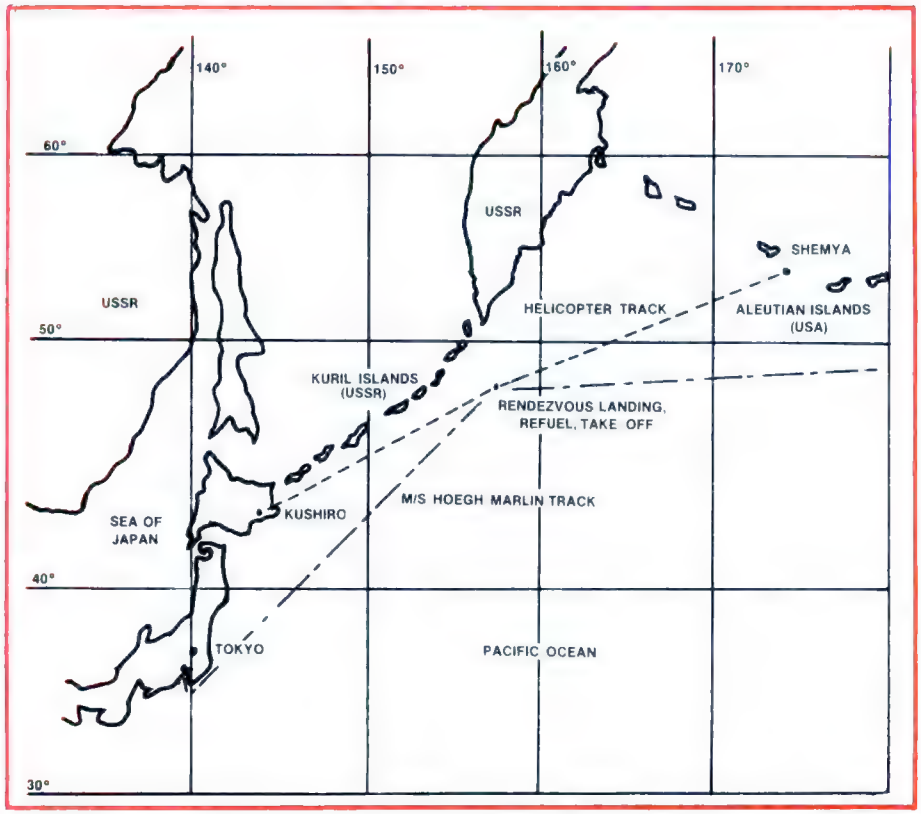
How I got involved

The phone rang one day in early June and Dick asked me how my farm was going. "OK," I answered. "What would you like?"

I soon got my answer. He wanted me to leave the farm, fly to Tokyo, board a container vessel which would then steam to a spot off the Kuril Islands, and supervise a mid-ocean landing and refuelling operation. He would then complete the leg to the Aleutians and I would continue with the ship to Seattle on the West Coast of the USA (having no other option!). I would also keep continuous contact with the helicopter by amateur radio. This was essential as Dick anticipated that at times he would be flying at only a few hundred feet above the ocean and would have only a few seconds to give warning of any failure.

During stages one and two of his around the world attempt, Dick had made contact with many amateurs using his Collins HF 220 SSB set and using the call-sign VK2DIK. These contacts he found interesting and useful.

The container vessel would carry a Yaesu FT-ONE transceiver and I would keep Dick informed of weather conditions in our area before he left Japan and during the course of the flight. The area off the Kurils is prone to heavy fog as warm fronts from the continent meet the cold, moist air over the ocean. If, after passing the point-of-no-return, a shipboard landing was judged impossible because of visibility, wind or



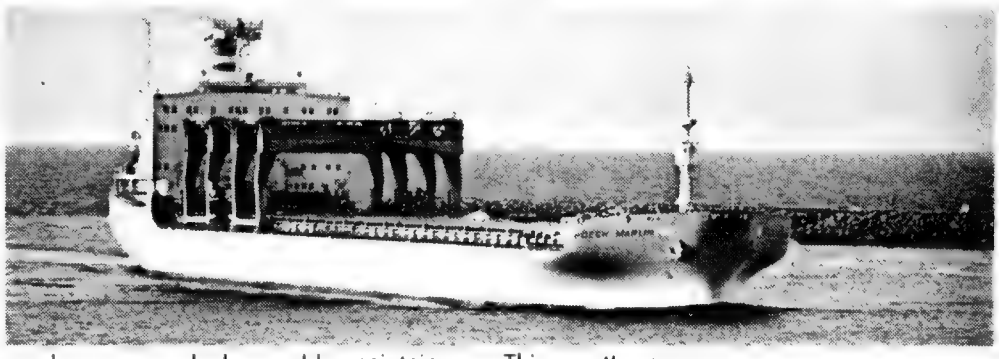
Safely on deck, Dick Smith greets the crew of the ***M/S Hoegh Marlin****. The huge container ship is shown below.*

sea conditions, Dick would have to turn to the doubly inhospitable coast of the USSR and hope for the best.

So that was how I came to be on board the M/S *Hoegh Marlin* on the night of Tuesday, June 21, in my cabin, surrounded by cartons of radio gear, wire dipoles, half a dozen enthusiastic Japanese technicians and not a little confusion. All was eventually sorted out and by 11 o'clock that night we were on the air with the FT-ONE and dipoles that loaded well on the 15-, 20- and 40-metre bands. The technicians from Yaesu departed happily, munching the last of the hamburgers.

Dick had been forced down by bad weather at a small fishing village on the coast of Japan a few hours flying out of Tokyo. The low pressure system that had caused this hold up was to travel with us and haunt us for the next few days. He then had completed the flight to Tokyo and visited the *Hoegh Marlin* that afternoon to review the plans. We prepared a duplicate chart to the one that Dick would carry in the aircraft so that I could plot his position reports. This work was done in the corridor outside my cabin, head down tail up, subject to the incredulous comments in Norwegian from passing crew members.

The final plan was for Dick to fly the helicopter from Tokyo to Kushiro, a northern airport in Japan, where a ground station would be set up at the shop of the local Yaesu dealer. Meanwhile the *Hoegh Marlin* would proceed from Tokyo towards the



rendezvous and I would maintain contact with VK2DIK helicopter mobile and, later, the ground station at Kushiro. We would also look for the opportunity to test the radio homing beacon whilst the helicopter was airborne.

On the day of the rendezvous, when the vessel was about seven hours steaming from the proposed meeting place, Dick would leave Kushiro and follow a course that took him along the boundary of the Buffer Zone and then fly east to the vessel with the intention of locating her and making the landing. Once that course of action had been taken, there would be no turning back as insufficient fuel would remain to make the coast of the USSR.

After landing on the *Hoegh Marlin*, VH-DIK would be refuelled and sent on her way to the American base of Shemya in the Aleutians, some 700 nautical miles to the northeast. Radio contact would be maintained throughout, starting on the 40-metre band and changing frequency as necessary.

This was the program:

- Tues June 21 Ship leaves Tokyo for rendezvous.
- Thurs June 23 VH-DIK leaves Tokyo for Kushiro and we conduct test of shipboard beacon.
- Fri June 24 Set up base station Kushiro. Prepare helicopter for departure.
- Sat June 25 VH-DIK to leave Kushiro for shipboard landing and refuelling. Helicopter to then leave ship for Aleutians, and vessel to resume course for Seattle

Amateur contacts

After leaving Tokyo, I made contact at least daily with a group of Australian amateurs, using the frequency of 21.385MHz during daylight and 14.136MHz in the evenings. The group

Across the Pacific by helicopter

consisted of Harry Caldecott VK2DA, Pierce Healy VK2APQ, Mike Barry VK2IH and Ron Payne VK2DBH.

I had also chosen working frequencies for the various bands which I had programmed into the FT-ONE, as Dick had also done with the Collins. I could change frequency with the turn of a switch but I regretted not having a co-axial switch to change dipoles.

After the *Hoegh Marlin* left Tokyo the weather pattern deteriorated. The low pressure system that had delayed Dick's arrival in Tokyo was still with us and moving at the same speed and in the same direction as we were. It reduced the ship's speed to 13.5 knots and every now and again a bump and shudder would run through the ship as she put her blunt bow into a solid wave.

It looked as though we were going to be south of the rendezvous point for touch-down which would mean a longer leg to the Aleutians and the possibility of the helicopter running out of fuel or daylight, or both! It could also mean head-winds of up to 20 knots, thus further reducing the helicopter's range.

On Friday 24th, good contact was made with the ground station at Kushiro on the 40-metre band. A party seemed to be in progress at the dealer's place. Dick was surrounded by transceivers, switches and ATU's and some 15 Japanese, none of whom appeared to be able to speak English. However it was a good party, as was the one we had on board to mark the longest day. The Norwegians celebrated the day by standing around the bar with drinks on the house. What a pity that some of these quaint customs are not observed in our part of the world!

That afternoon, the captain of the *Hoegh Marlin* held a final briefing for those who were to take part in the refuelling operation. Several important safety precautions were to be followed: life rings on strong lines were to be attached to both port and starboard sides, a fire team in full reflective clothing was to stand by with pressurised fire hoses and extinguishers laid out on deck, and two men were to stand by a small life raft that could be lowered in seconds. The fuel drums were stored on the foredeck, ready to be rolled aft only after the helicopter had landed.

A hazardous flight

At 0340 Japanese standard time on Saturday, June 25, VH-DIK lifted off from Kushiro Airport in heavy rain and started flying along the coast of Japan for the first turning point about 80 nautical miles out over the ocean and on the edge of the Japan/USSR buffer zone. Communication was immediately established between the *Hoegh Marlin* and VK2DIK on 7.060MHz.

By 0445 the rain had cleared and soon after the tops of volcanoes on the chain of islands that make up the Kurils were visible from the aircraft through low cloud. The *Hoegh Marlin* was proceeding on course to the rendezvous in patchy fog and poor visibility. Each time I looked out the window I became more doubtful about our chances of making a rendezvous. The ship was travelling at maximum allowable sustained revs but we were still under the influence of the low pressure system with head winds and swell from the north.

Conditions at the ship gradually improved and by 0700 the fog had lifted and the cloud base was at about 500ft. To our west, Dick was flying above thick cloud with the occasional volcano peak poking through and the height of the cloud base unknown.

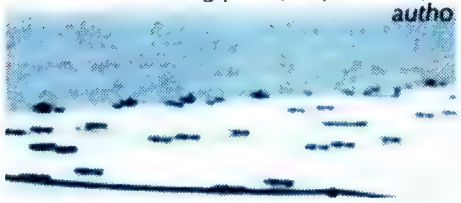
To descend through the cloud hoping for a fog-free space between the cloud base and the water could lead to disaster, so I was asked to advise the Department of Civil Aviation and Canberra Operations that the landing may have to be aborted. If that happened, VH-DIK would be forced to fly into USSR air space in an attempt to seek a landing. Harry Caldecott, VK2DA was standing by on 14.146MHz and passed the message to him for action.

Dick's wife, Pip, and daughters Hayley and Jenny were listening to our radio conversations at the family home in Sydney and, after some prompting, Dick remembered that it was Jenny's birthday. So, despite the forbidding surroundings and the hidden tensions a rich baritone voice floated over the airways: "Happy birthday to you, happy birthday to you, happy birthday dear Jenny . . ." and so on. For a moment, I had a vision of hundreds of listeners around the world reaching for the gain control before something horrible happened to the front end of their receivers!

At the *Hoegh Marlin* conditions were steadily improving. The fog had dispersed completely and the cloud was lifting and looked like breaking up altogether. I had also received a report from Shemya, in the Aleutians, that conditions there were reasonable with high visibility and light winds.

From 9 o'clock that morning onwards I was in continuous contact with the helicopter. Around the ship conditions were almost perfect for a landing; the cloud base was about 1000ft, the wind 5kts from the north, the sea slight and

Just after touch-down, helicopt VH-DIK is dwarfed by its sea-goi landing pad. (All photos by th autho



the ship rolling no more than about 3°. At the helicopter things were quite different. Dick could not see the ocean and could only guess at conditions below the cloud base. He could still see the tops of volcanoes on his port side rising through a solid mass of cloud. A decision had to be made within minutes either to penetrate the cloud and search for the ship in unknown conditions or to head west into the USSR looking for a place to land.

Dick decided to have a closer look at the islands and see whether a landing would be possible. He came back to me with a report of steep, ice-covered cliffs, small glaciers and a narrow space between the cliffs and the edge of the crater that could be wide and flat enough for a landing . . . but not very promising! So we proceeded towards the rendezvous and Dick kept to the buffer zone hoping for an improvement within the short time left.

Tension was rising at both ends of the communication chain! I brought the Master of the *Hoegh Marlin* to the microphone to reassure Dick of the conditions surrounding the ship, being careful not to apply any pressure that could mar his judgement. I kept on reporting conditions at the ship and Dick kept telling me how impossible the islands looked for a landing.

Then, a break in the clouds, a sight of the ocean and Dick was through; off to the ship, in the narrow space between the cloud base and the water, in good visibility. VH-DIK was now homing in on the beacon, approaching us from about 60 miles away and in direct contact with our skipper on the bridge. The ship swung head to wind and speed reduced for the landing.

"I . . . well made it!" were Dick's first words as I opened the helicopter door, an obvious release of tension from a man who seldom uses strong language.

The fuel drums were rolled from their position forward and I commenced refuelling. About 170 gallons US were used to bring the aircraft tanks back to "full" and, after a quick lunch, Dick was ready to head for the US Airforce Base at Shemya. Time was important as there could be headwinds and Dick had to find the base and land before dark that evening.

The take-off crew stood by, the deck

was cleared, the fire crew stood ready and the helicopter turbine started. After what seemed minutes the overloaded aircraft lifted from the deck. Maximum overload power could be sustained for only a few seconds. The helicopter nose dipped for forward motion and VH-DIK moved swiftly over the deck, missing the hold-down studs by inches. A quick circuit of the ship and away she went for Shemya. The *Hoegh Marlin* changed course for Seattle and we all breathed freely.

I maintained contact with the aircraft on the leg to the US base until the airport radio came up and talked Dick down in the gathering dusk.

Champagne

That evening the skipper opened the bar for a champagne celebration and we reviewed the landing and take-off. All had gone well. Good navigation at both the helicopter and the ship meant that each knew where the other was during the entire flight. Once through the cloud, the beacon guided the aircraft to within visual range. Then it was over to each skipper, one to manoeuvre the boat to minimise pitch and roll and the other to make the landing. The take-off had been successful, but only just. The overloaded helicopter had almost fouled the deck-studs as the ship rolled on lift-off.

Communications had been excellent throughout, both myself and the ground station plotting each position as reported and, in the later stages, passing each plot to the bridge. We were able to keep VK2DIK informed of our weather and sea conditions as well as alert the authorities that a landing in the USSR would be necessary unless the cloud lifted.

The sole communication from the aircraft during the 15 hours of flying time had been by amateur radio — to the base in Japan and to the *Hoegh Marlin*.

The most difficult part of the operation, and the most courageous decision, was for Dick Smith to leave his grip, however tenuous, on the half-hidden islands and grope through the overcast to find a vessel 60 miles away. In doing this Dick knew that if he were not successful, a return to the coast for landing would be almost impossible.

Special tribute must also be paid to the skipper and crew of the *Hoegh Marlin*. They were all vitally concerned that everything should go according to plan and regarded the operation as a test of their seamanship. Without their professionalism, the landing would not have been possible.

Dick, for his part, was delighted with the organisation and success of the operation. He was to comment later on the contrast between sitting in the tiny bubble of the helicopter for seven hours and, within minutes of landing, having a smorgasbord with the skipper in the comfortable dining room of the *Hoegh Marlin*

The shipboard landing, although important in skill, training and coordination of a number of disciplines, forms only part of a much bigger achievement: that of the first solo circumnavigation of the world by a rotary wing aircraft.

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Y 1018	6.0000 mHz	Series	5.00	4.50
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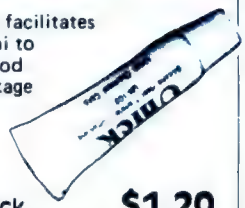

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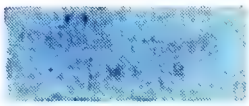

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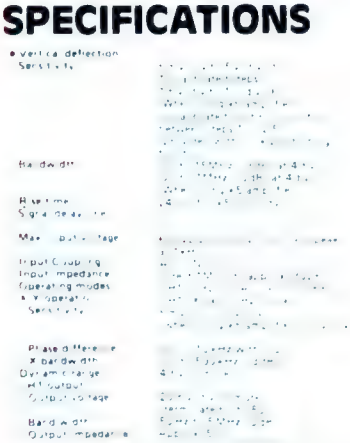

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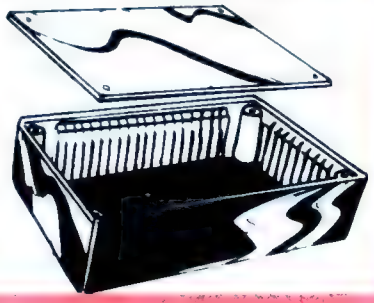

FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 149

We mustn't kill CD for the sake o

Compact disc is by far the most promising system so far devised to bring top quality sound reproduction into the home. Yet, like the fabled goose, it is in danger of being fatally mauled by those who are over-anxious to get their hands on the golden eggs that it will hopefully lay.

FORUM

Conducted by Neville Williams

I've had a few uneasy feelings, of late, about the industry's approach to compact disc but what brought the matter to a head and triggered the above title and introduction was a news item in the October issue of the American journal "Stereo Review". I quote:

"Sales of Compact Disc (CD) players in Japan are expected to overtake those of conventional turntables during the fall . . . NAD is preparing to launch a CD player this winter . . . Technics will begin selling a $700 CD player in the US any day now . . . watch for a number of $599 CD players from various sources by January and some $399 bare bones machines next spring or summer."

The first part of the paragraph is interesting but routine. Demand for CD players was expected to escalate rapidly but, even so, it must be particularly keen in Japan to be overtaking that for conventional phono decks, already. Prices were expected to fall with rising production and the announcement of a $700 CD player from Technics for the US market holds no real surprise. Nor is it surprising that other companies should be looking beyond the Technics release to a figure of $600 (sorry, $599).

But the sting in the tail is the throw-away remark about "bare bones machines" next spring or summer.

Just like that . . . good grief!

With friends like these. . .

As I remarked earlier the compact disc is the most promising system yet devised to bring top quality sound reproduction into the home. It has won world-wide acceptance, a unique degree of cooperation and faces no immediate rival. It has presented the world hifi industry with a never-to-be-repeated opportunity to launch and maintain a new standard of quality but, with compact disc commercially less than a year old, a section of the industry is apparently talking blithely about the release of "bare bones" players.

With friends like that, the compact disc doesn't need enemies!

For sure, the compact disc, and digital audio in general, has had its share of "enemies" or — to use a less emotive term — its share of critics who have expressed strong dislike, both for the sound and the theory behind it. However, it is hard to see such opinion prevailing at this late stage.

As for the sound of digital reproduction, there seems to be emerging recognition that much of the dislike is traceable, not to the digital system itself, but to an unaccustomed transparency which exposes limitations at the source, previously masked by analog processes: poor acoustics, multi-miking with its many phase problems, and distortion in the mixing and effects equipment.

Indeed, as enthusiasts become more accustomed to compact discs, one of their most frequently heard complaints has to do with the inclusion of program material which has come from an analog source! How the pendulum has swung!

The theoretical objection to digital audio is based partly on rejection of the sampling concept per se, and partly on the conviction that the samples are not sufficiently small, particularly for lower level signals. In short, they (the objectors) dislike the whole idea of reconstructing a waveform from samples but, if it is to be done, then at least the samples should be defined by something more accurate than a linear 14-bit or 16-bit digital system and perhaps should be a logarithmic sampling system.

It is difficult to reject the sampling principle out of hand because, as we have pointed out on previous occasions, AM broadcasting, FM-stereo broadcasting and magnetic tape recording all involve sampling, with the audio contour being recovered from pulses of carrier, sub-carrier or HF bias.

Apprehension about the adequacy of the 16-bit encoding/decoding process is more persistent, as typified by a letter from H. W. Holdaway of Coogee, NSW, which was published in "Letters to the Editor" in the October issue. He feels that distortion due to sampling error of low level signals must surely be as serious as crossover distortion in the early transistor amplifiers, and just as fatiguing to the listener.

He suggests that a modified method of encoding/decoding should be worked out that would deal more effectively with low-level signals. It might conceivably involve the use of dbx encoding. Says Mr Holdaway:

"I believe it is important that such steps be taken quickly, while yet there is only limited software available. Failure to come to grips with the problem will lead to disillusionment and many unhappy customers."

Low level distortion

What Mr Holdaway says is undoubtedly true in principle and is, in fact, confirmed by Technics themselves in the manual for their SL-P10 compact disc player: the level of distortion does rise with decreasing signal level. There is an enormous discrepancy, however, between the level of distortion anticipated by Mr Holdaway and that revealed by Technics' specifications for the D/A conversion process in the SL-P10.

Mr Holdaway mentions (signal) "levels of about 1.5% of maximum" as an area of concern. It is unclear whether he has in mind a percentage of maximum power (18dB down) or signal voltage (36dB down) but, in both cases, Technics' figures for D/A conversion distortion are very small: 0.01% for −18dB, and 0.08% for −36dB. Both are way below what one might suggest as a level of crossover distortion likely to cause listener fatigue.

Technics show a distortion figure of just over 0.1% for a 1.05kHz test tone 40dB below maximum amplitude. They terminate the curve there, presumably because they believe that the level of distortion products for a fundamental beyond −40dB would be below the threshold of hearing and/or noise ambient.

By projection of what is essentially a linear relationship, one can predict a 1% distortion level at −60dB and 10% at −80dB. But, while the latter figure looks awful at first glance, it is necessary to remember that a listener in any practical listening situation would be hard put to it to hear the fundamental so far down in the dynamic range, let alone spurious

a few easy bucks!

distortion products below that level again!

In any case, while the CD system dynamic range is around 95dB or more, it is hardly likely that normal music programs would be allowed to exceed much more than about 75dB below maximum output level.

While much more could be said on the subject, on both sides, it has been interesting to note the attitude of reviewers for "Gramophone" magazine, who can scarcely be written off as a group of hifi trendies. They accept digital mastering as routine and respectable, and consistently commend CD versions for revealing subtleties of sound and performance that didn't make it through the equivalent analog pressing.

In the face of that sort of reaction, I can't help but feel that our correspondent is likely to be disappointed in his bid to call for a halt and a re-think of the whole digital/CD scene.

But let's get back to those gentlemen who are reportedly planning the release of "bare bones" CD players. How do they imagine that they will be able to strip another $200 from a budget price that, itself, remains to be achieved?

I would not be greatly concerned if their answer was simply to cut back on the cosmetics and to reduce the control facilities to a basic selection of tracks, start, stop and pause. At least the buyers would be faced with a clear compromise which they could accept or reject.

But I can't see it stopping there. The designers are going to be under strong pressure to save dollars also on the precision spindle and traverse mechanism, the laser tracking circuitry, the error correction system, the D/A conversion, and so on.

I have never ceased to wonder at the ability of the laser system to track that tiny spiral of tracks, but I have also had cause to wonder at the distortion which results when something goes amiss with the tracking. Even though the problem may be a single greasy fingerprint on the surface, it can cause the affected tracks to sound exactly as if they were LP tracks being played by a badly mistracking stylus — one with insufficient playing weight, or suspended on a ball of fluff.

If some manufacturers yield to the temptation to cut back in critical areas, they will invite an increase in basic distortion, plus traumas of a more serious nature if the player fails to cope adequately with minor imperfections in typical discs.

It has been said in the past that, unlike traditional record players, CD players should all sound substantially similar, with the difference being mainly in finish, appearance and facilities. This should be true of players which are adequately designed but certainly not of those where corners have been cut in vital areas.

I only hope that we are not about to replace a race of cheap and nasty phono decks with cheap and nasty CD players!

CD players for the car

A further area of concern is the widespread assumption that compact disc players belong automatically in the family car.

It is true that the possibility of in-vehicle use was a factor which supported the choice of a 12cm diameter disc, rather than something larger. It is also true that manufacturers expect to be able to mass-produce players capable of coping with in-vehicle vibration levels. But that doesn't mean that the present generation of compact discs is ready for the road.

Amongst other things, in the context of home listening, compact discs offer extra playing time per side, versatile track selection, high quality, low noise and high dynamic range.

On the highway, extra playing time could be handy, and high quality reproduction would be a bonus, within the limitations of what can reasonably be installed in a family car. Very low system noise would not count in the majority of road conditions, while versatile track selection would be subject to what could reasonably be installed and operated in the way of push-buttons.

High dynamic range — already the subject of debate for in-home listening — is clearly out of place in a car. Even with pre-monitored programming, dissension is not uncommon between those who want to belt their ears with music and others who want to talk, or simply to be as quiet as they can under touring conditions. Not many of us own vehicles with partitions between the front and rear seats!

Imagine the problem of bringing into this situation recordings in which neither the producer nor the musicians have been inhibited by the traditional constraints on dynamic range. Or where, perchance, they may be intent on "letting their heads go".

If there's a problem fitting 80dB of dynamic range on top of a 45dB ambient in a domestic lounge room, how much

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Miniscribe recently announced that they have successfully negotiated a deal making them a preferred supplier on the IBM PC Programme.

WHISPERING GALLERY.

PSST! 3.3 Mbytes on a half-height 5¼" floppy? Look out for this one early in '84. Incidentally we've heard that the same drive will read standard 48 and 96 TPI media.

A double-sided 3" micro floppy is in the works. Following an agreement between the big three proposers of the 3" standard a US manufacturer is well on the way to launching their own version. We should see product in Australia soon.

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greater would be the problem of trying to do so in a moving vehicle. In that situation, we need more dynamic range like a hole in the roof!

Dynamic range

In short, a great many compact discs, with whispering pianissimos and great, shattering sonic climaxes simply will not translate from the loungeroom to the family car as practical program material, quite apart from any consideration of road safety due to driver distraction. If we are going to travel or even picnic with compact discs, we may have to select them for low — not high — dynamic range.

Who knows: they may have to be produced that way in the first place.

And, just in case you are thinking in terms of car CD players with built-in volume compression, let me sound a word of warning: No matter how it is effected, the end result of compressing dynamic range is to raise the level of those whisper-soft, down-in-the-ambient passages by, say, 20dB.

Reverting to what we said earlier, if we take the low-level passages from a digital recording (say −60 to −80dB) and artificially boost them by 20dB, they come complete with a distortion content of between 1% and 10%.

I would not go so far as to suggest that volume compression in car CD players will be impractical; rather that it will need to be applied with considerable discretion.

In the meantime, I feel that, if listening conditions in a vehicle tend to nullify the refinements and advantages of compact disc, they must also tend to nullify any undue haste to discard the present car stereo cassette player. Somehow, cars and compact cassettes seem to belong together.

And program content?

Getting away from technicalities, complaint is beginning to mount, overseas, about the program content on some compact discs.

As mentioned earlier, the most frequent complaint is probably the inclusion of material from analog sources, complete with an inherent residual noise and intermodulation distortion that can readily be noticed by keen ears.

The important point here, I feel, is not the inclusion of analog sourced material per se, but its inclusion in circumstances which suggest that the producers hoped you wouldn't notice. Analog tracks between digitally sourced tracks on a demonstration disc provide a classic example.

What is necessary, I believe, is a simple, honest notation relating to individual tracks or the work as a whole, which indicates the nature of the original recording, eg,

* Analog master, 1978.
† Digital master, 1983.

Such notation would not be a final word on the quality or the merit of the recording but it would be an act of good faith to buyers who are technology conscious.

The fact is that an enormous treasure trove of recorded sound exists in analog form and some of it will inevitably gravitate to compact disc — not as a technical necessity but as a service to those who may ultimately want to standardise on the one player. Suitable endorsement would allow purchasers to understand better what they are buying.

Playing time

No less important is the duration of the program on a compact disc. They will accommodate up to about 73 minutes but the figure that has been most frequently publicised is 60 minutes and this is what purchasers really expect and pay for. However, if software companies take the easy way out and simply re-master the contents of LPs to the one side of a compact disc, the playing time in many cases will end up at 40-45 minutes total.

"Not good enough" say the critics as they recall what happened with some LPs in the bad old days, which played for perhaps 13-14 minutes per side. Compact discs are not cheap to make and not cheap to buy and it is up to manufacturers to ensure that purchasers get their money's worth, even if it means re-grouping tracks and re-writing existing jacket notes.

These days, re-grouping tracks does not present the risk to quality that it once did. If the original masters are copied meticulously on to a digital tape, they can be edited, copied and re-assembled under computer control without any cumulative quality loss, before finally being transferred to compact disc.

Over the past two or three years, the world hifi industry has been groggy, not from any lack of product, but as the result of widespread recession and competition from video. Compact disc could provide a basis for recovery — a steady supply of golden eggs — providing they don't kill the goose or inhibit its productivity!

Sony's 701ES PCM adapter is a means of recording audio in digital format on a video cassette recorder.

Sony 701ES PCM Adapter

At present there is only one way to make sound recordings to the same standard as the digital audio disc and that is to use a PCM adapter with a video cassette recorder. We recently tested the latest PCM adapter from Sony, the PCM-701ES and it produces performance figures which beat the best available reel and cassette machines by far.

PCM processors have been developed as a solution to the problem of high distortion levels and low signal to noise ratios found in conventional analog tape recording systems. At present analog tape systems are one of the weaker links in the recording chain, and this processor goes a long way to remedying the situation.

The PCM-701ES works by sampling an audio signal and then digitally coding the level of the signal at each sampling instant. The digital signals representing the audio samples are then combined with error correction and control signals and the whole lot suitably positioned within the standard "lines" of the PAL video format. The signal may then be taped using a standard VCR, giving recording times of up to 130 minutes. The format of the VCR is unimportant and either "Beta" or "VHS" machines may be used.

The digital coding of the audio samples may be switched between a 14-bit format and a 16-bit format. The 14-bit format is an industry standard while the 16-bit format is a non-standard format, offering slightly better noise and distortion figures, worked out by Sony to fit into the 14-bit format. The two formats appear to be compatible in that a tape made using the 16-bit format can by played back on a machine equipped with the 14-bit format only.

As with most things, to get better performance (ie 16-bit resolution) some sort of compromise has to be made this case it is loss of half the error correction capability. This occurs because one of the two error correction words in the 14-bit format is replaced with the 15th and 16th bits of the audio samples in the 16-bit mode.

Because of the reduced error correction in the 16-bit format, recordings using this format should be made on good quality video tapes.

The sampling frequency used in the PCM-701ES is 44.1kHz which gives a theoretical upper limit to the frequency response of 22.05kHz. In practice the response above 20kHz is rolled off by a very sharp filter to prevent "aliasing".

One obvious question regarding the 16-bit format is whether this format is identical to the 16-bit format used in the Compact Disc. If so, this would allow direct digital-to-digital recordings to be made between the two (providing a digital output were fitted to the Compact Disc player).

The answer to this question is no. The reason is that all signals in the PCM-701ES are maintained in a 14-bit word length even when the PCM-701ES is operating in the 16-bit mode. The Compact Disc operates with all 16-bit words and hence the two systems are imcompatible.

Specifications of the PCM-701ES claim a mass of 8.5kg, dimensions of 430 × 375 × 80mm (W × D × H) and a power consumption of 40W.

The front panel of the PCM-701ES is relatively sparse when compared with normal cassette decks since there are no tape transport controls. The front panel has a brush (or scratch) finish which has been black anodised with a matt appearance. In the top left hand corner of the front panel is the power on/off switch, while in the bottom left hand corner is a headphone socket and headphone volume control. The volume control is not continuously variable but

has switched attenuation ranges of 0, 6, 12, 18 and 24dB.

In the centre right of the front panel is a large window housing a fluorescent display. Main feature of the display is the wide range level meters which run almost the full length of the window. The level meters have a calibrated range from −50 to 0dB with 0dB corresponding to an input of 0.775V. At the right hand end of each level meter are back-lit indicators containing the word "over" which illuminate whenever the recording level reaches +1dB.

The level meters are peak reading and show the instantaneous level of the signal. A peak-hold facility is fitted to the meters and works by indicating the level of the highest peaks with a dot display while displaying transients below the peak with a bar display.

At either end of the level meters are back-lit indicators which illuminate when appropriate to show the status of the PCM-701ES. "Copy Prohibiting" indicates that the tape being played back carries a digital code which prevents digital copies of the tape being made. "Res 14-bit" and "Res 16-bit" indicate the resolution with which the PCM-701ES is recording a signal. During playback of a tape, the indicators automatically show the resolution with which the tape is recorded, regardless of the resolution setting of the PCM-701ES.

The "Emphasis" indicator illuminates whenever the tape being played back has had emphasis applied. Emphasis is just the boosting of high frequencies (in this case above 1kHz) in a signal before it is placed on tape. When played back, the high frequencies are cut by the same amount as they were originally boosted, reducing any high frequency noise added during the period when the signal was emphasised. All tapes made via the PCM-701ES have emphasis automatically applied to them.

The "PB Muting" (playback muting) indicator lights when the muting circuitry inside the PCM-701ES is investigating dropouts in the signal. The muting circuitry can be disabled via a front panel switch however in this state the muting circuitry is still connected to the signal so the "PB Muting" indicator will light when dropouts occur even though muting is not applied.

On the extreme right of the level meters are two further back lit indicators. The first of these is the "Rec Mute" (record mute) indicator which lights whenever the Rec Mute pushbutton is pressed. The second indicator displays the word "Tracking" whenever the bar graph meters are switched from their usual level meter functions to a tracking meter function to allow optimum adjustment of the VCR heads.

Along the bottom edge of the front panel are eight pushbuttons which control most of the PCM-701ES functions. Included in these pushbuttons are a "Copy" button, a "PB Muting" button, three buttons for controlling the level meters, a "Rec Mute" button and two buttons to select between 14 and 16-bit resolution when recording. When the "Copy" button is pressed, the digital signal from the tape being played is made available at the Copy Out socket on the rear panel of the PCM-701ES. A second VCR may be connected and digital copies of the first tape made.

The "PB Mute" button controls the muting circuitry mentioned earlier and turns it off when not required.

The level meter control buttons switch the meter between three indicating modes. In the auto mode (activated by pressing the "Auto" button), peaks are held for approximately 1.7 seconds while in the manual mode (activated by pressing the "Manual" button) the highest signal peak is held indefinitely or until reset by a second touch on the manual button. When the "Tracking/Level" selector button is pressed, the right channel bar graph display changes to a tracking meter.

The "Rec Mute" button places a blank on the tape for as long as the button is pressed. It does not disable the level meters or the headphone output and these may be used to monitor incoming signals during the muted period. The "14-bit" and "16-bit" resolution buttons select the required resolution for the recording.

In the top right hand corner of the front panel are concentrically mounted right and left channel recording level controls. A friction clutch arrangement between the controls allows them to be used as a single control or as two individual controls as required.

The rear panel of the PCM-701ES contains eight RCA sockets placed in two groups of four. The first group of four are the line inputs and outputs which handle audio frequency signals. The second group of four sockets carry video frequency information. Two of these sockets are labelled video in and video out, and carry the video signal to and from the VCR. The third socket is labelled copy out and produces a digital output when the copy button is pressed. The Monitor Out socket gives a composite video output which may be connected to a television monitor.

If this is done, black and white patterns of bits representing the digitally encoded music will be displayed on the monitor.

Performance results

Record/replay response is the flattest we have ever seen from a piece of recording equipment being within ±0.5dB over the range 10Hz to 20kHz. The response is actually flat from 50Hz to 16kHz except for a slight rise between 7 and 9kHz of +0.2dB. Above 20kHz the response falls very quickly due to the high order, low pass filter included to prevent aliasing.

In both 16-bit and 14-bit modes, the signal to noise ratio was 90dB referenced to the 0dB input level. Separation between channels was measured as 88dB at 100Hz, 88dB at 1kHz and 76dB at 10kHz for the 16-bit mode and 88dB at 100Hz, 86dB at 1kHz and 76dB at 10kHz for the 14-bit mode.

Two sets of total harmonic distortion measurments were taken. The first set of measurements were made at 0dB for the frequencies 100Hz, 1kHz and 10kHz. Distortion readings in the 16-bit mode for these frequencies were 0.0037%, 0.0045% and 0.01% respectively. In the 14-bit mode the figures worsened slightly to 0.0045%, 0.0045% and 0.012% for the respective frequencies.

The second set of distortion measurements were made at 1kHz for input levels of −20, −10, 0, +1, +2 and +3dB. In the 16-bit mode the respective total harmonic distortion measurements were: 0.026%, 0.0085%, 0.0037%, 0.21%, 3.4% and 7.5%. In 14-bit mode the corresponding measurements were: 0.037%, 0.012%, 0.0045%, 0.21%, 3.4%, and 7.5%.

These distortion figures are typical of

PCM-701ES Specifications

Sampling frequency	44.1kHz
Quantization	14-bit linear or 16-bit linear
Frequency response	10Hz to 20kHz ±0.5dB
Harmonic distortion	Less than 0.007% (14-bit)
	Less than 0.005% (16-bit)
Dynamic range	More than 86dB (14-bit)
	More than 90dB (16-bit)
Channel separation	More than 80dB
Wow and flutter	Below measurable limit
Input level for 0dB	0.775V

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DSE/A850/P4

Convert your car to . . .

Breakerless ignition

by JOHN CLARKE

Are you one of those hobbyists who would like to have a breakerless ignition system on your car but do not wish to make your own optical system? Then here is your chance to change over to a breakerless system using a Hall Effect device in your distributor.

Our Transistor Assisted Ignition system published in February of this year included details of an optical breakerless system using a phototransistor, LED and a suitable interface circuit but the reader had to solve the mechanical problems. He had to make his own optical breaker plate which requires very precise metalwork and he had to make up a mounting arrangement for the LED and phototransistor.

Now these mechanical problems have been solved with a new Hall Effect distributor kit. Made by EDA Sparkrite of the UK, it is marketed by Jaycar. The kit includes all the hardware necessary for the distributors in most cars sold in Australia. There are a couple of glaring exceptions unfortunately, including the much venerated six-cylinder Holden Kingswood. A crying shame.

Of course, there's nothing to stop you from making your own hardware to match the distributor in your car.

The basic mechanical concept is simple. A Hall Effect switch is mounted in place of the contact points and a ring magnet is fitted over the distributor cam. The magnet has the same number of poles as the cam has faces and these are equally spaced to provide the appropriate timing pulses from the Hall Effect device to the following electronic ignition circuitry.

The advantage of using an all-electronic system such as this Hall Effect system rather than a hybrid system utilising the distributor contact set is that, once set, the ignition timing will always be right. It will not vary due to the gradual wearing down of the contact breaker rubbing block and there will be no "timing scatter" due to distributor cam wobble or wear in the bearings.

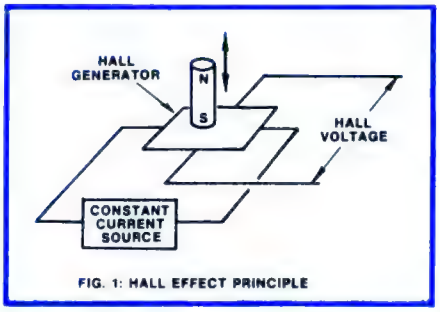
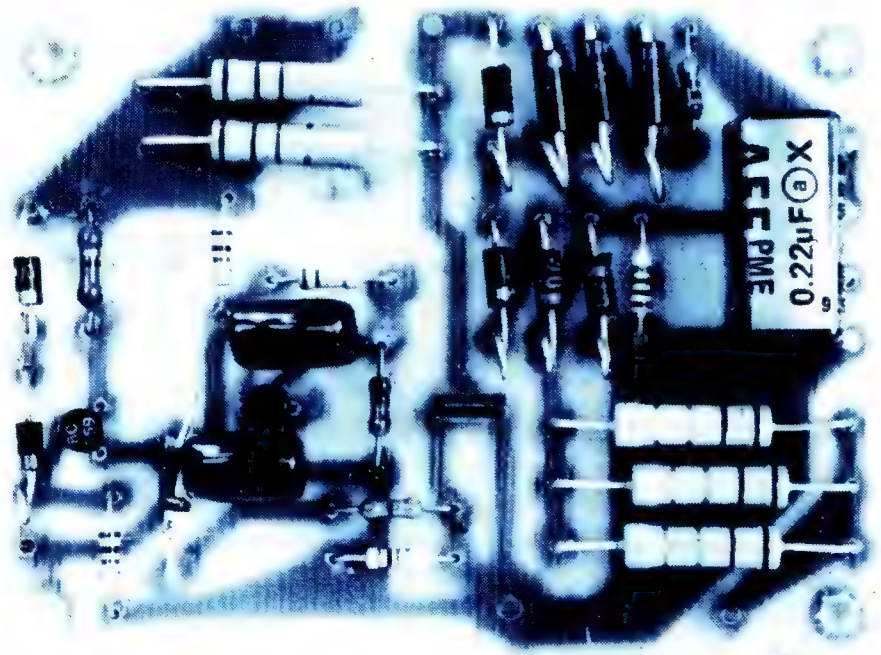


FIG. 1: HALL EFFECT PRINCIPLE

Even with a brand new distributor the timing differences from cylinder to cylinder can be as much as 5% and this does contribute to uneven running, particularly at idle speeds. With the Hall Effect system installed the engine will run noticeably smoother and it will stay that way.

One small point to remember is that even an all-electronic ignition system is not completely maintenance free. The spark plugs still have to be checked for fouling and correct gap setting at regular intervals of say 5000 to 10,000 kilometres. And at these times it would probably also be wise to do a routine check of timing, just to satisfy yourself that it is still "spot-on".



View of the assembled PCB. Note the shock relieving loops in the diode leads.

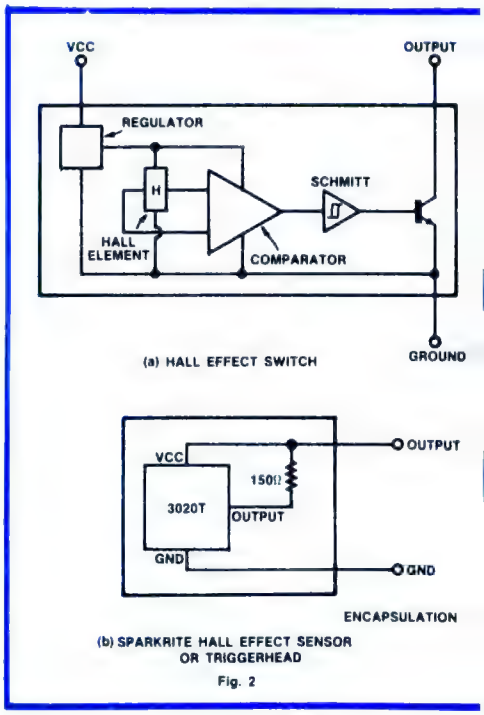


Fig. 2

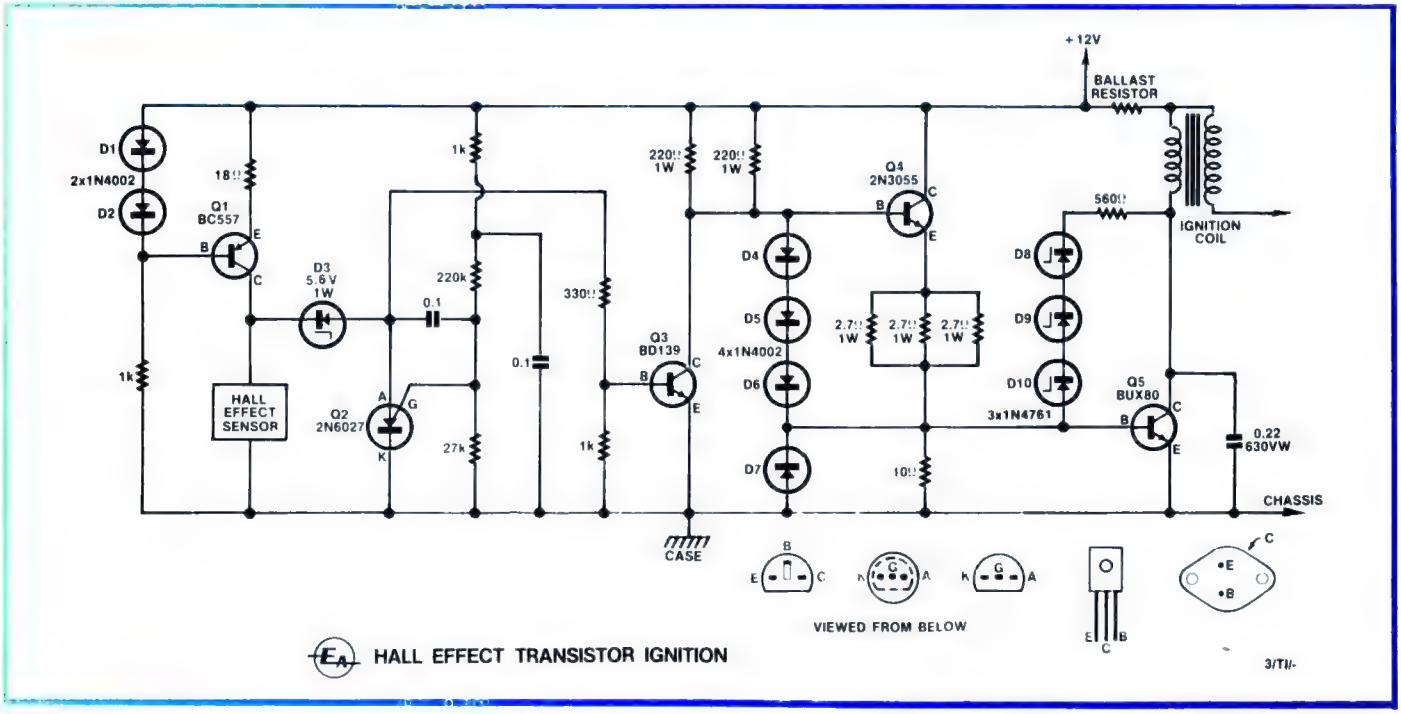
The distributor kit comes packed in a plastic wallet and is suitable for use with most distributors.

What is the Hall Effect?

The Hall Effect sensor principle is shown in Fig. 1. It consists of a thin strip of semiconductor material through which a current is passed. When a magnet is brought near, such that its field is directed at right angles to the face of the semiconductor, a small voltage appears at the contacts placed across the narrow dimension of the strip. As the magnet is removed the voltage drops to zero.

A practical Hall Effect device is depicted in Fig. 2a. This comprises a voltage regulator, a Hall cell, a comparator connected across the Hall cell and a Schmitt trigger which drives an open-collector transistor. The comparator and Schmitt trigger render the Hall Effect switch characteristics less dependent on the magnetic flux.

Fig. 2b shows how the three-terminal Hall Effect device has been used by Sparkrite in their sensor. Effectively, the



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Breakerless ignition

three-terminal device has been converted to a two-terminal device by the connection of a 150Ω resistor between the output and Vcc. By making the GND terminal of the sensor the metal foot, the device has only one lead connection which makes it equivalent to a standard contact breaker, although it is not intended to switch the coil directly or carry heavy currents.

The Sparkrite sensor is actually an epoxy encapsulation of a Sprague UGS-3020T Hall Effect switch (or equivalent) together with the aforementioned 150Ω resistor. The Sprague device is very similar in appearance to a TO-92 plastic transistor, although perhaps a little smaller, and is rated for an operating temperature range from −40 to 125 degrees Celsius.

Sparkrite operate the Hall Effect device by use of a ring magnet. In fact it consists of a number of radial magnets with all north poles on the inside of the ring and the south poles used to turn on the Hall Effect device.

The circuits

Two circuits are shown, one using the Hall Effect sensor to trigger the Transistor Assisted Ignition first described in December 1979 and subsequently updated in February 1983 and the other showing adaptation for the Capacitor Discharge Ignition first described in August 1970 and updated in July 1975. We shall discuss the modification to the transistor ignition first.

Q1 is a constant current source which feeds the Hall Effect device and zener diode D3. The current from Q1 is set at about 33mA by diodes D1 and D2. Strictly speaking a single resistor could have been used instead of Q1 but the constant current source makes the switching of the Hall Effect device independent of battery voltage fluctuations which would otherwise lead to changes in ignition timing.

PARTS LIST

TAI Adapter Kit

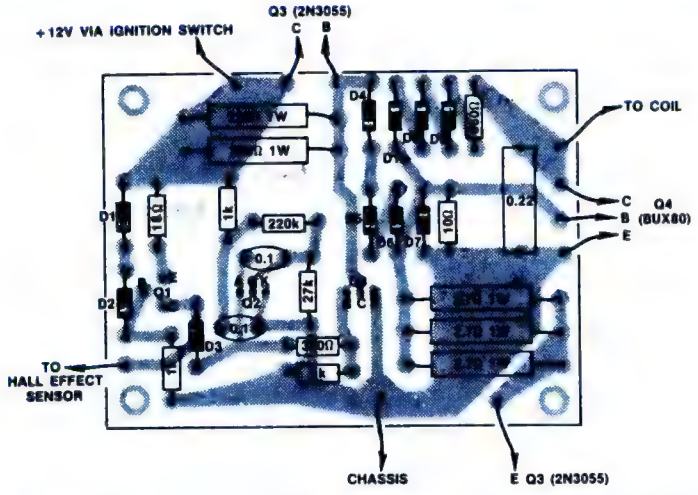
1 Hall Effect distributor kit (EDA Sparkrite)
1 printed circuit board, code 83ti12, 93x69mm
1 BC557 PNP transistor
1 5.6V zener diode
2 1N4002 diodes

RESISTORS (¼W or ½W, 5%)
1x220kΩ, 1x27kΩ, 1x1kΩ, 1x330Ω, 1x18Ω.

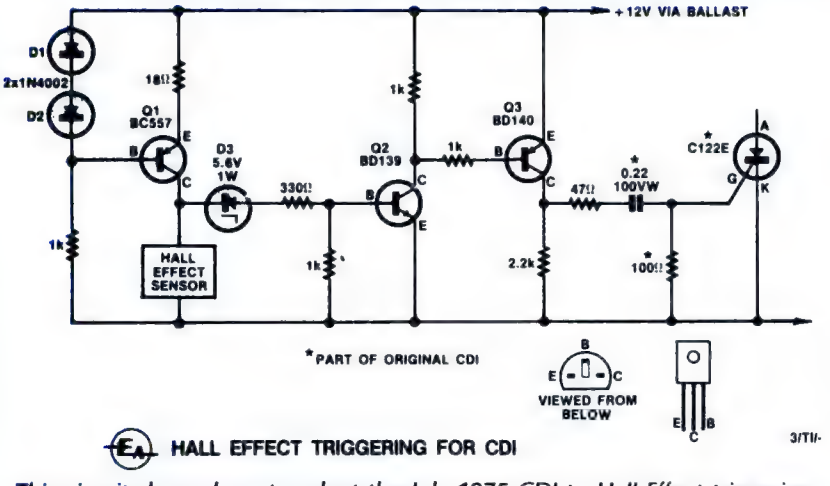
CDI Adapter Kit

1 Hall Effect distributor kit (EDA Sparkrite)
1 piece of stripboard (see text)
1 BC557 PNP transistor
1 BD139 NPN transistor
1 BD140 PNP transistor
2 1N4002 diodes
1 5.6V zener diode

RESISTORS
1x2.2kΩ, 4x1kΩ, 1x330Ω, 1x47Ω, 1x18Ω.



Parts overlay diagram for the new Transistor Assisted Ignition PCB.



This circuit shows how to adapt the July 1975 CDI to Hall Effect triggering.

When one of the south poles of the ring magnet is adjacent to the Hall Effect device it is turned on and so the voltage at the collector is less than 5 volts. This means that no current flows through zener diode D3 and so Q3 is not biased on. In turn, this means that Q4 and Q5 are conducting and current is flowing through the ignition coil.

When the magnet south pole moves away, the Hall Effect device stops conducting and the voltage at the collector of Q1 rises so that D3 conducts, turning on Q3. This turns off Q4 and Q5 which allows the coil to fire the spark plug.

Q3 does not remain in conduction for the whole time that the Hall Effect device is off. This is because of the dwell extension feature provided by the programmable unijunction transistor (PUT) Q2. This operates as follows:

When D3 is not conducting, the anode of Q2 is essentially held at chassis potential by the base resistors of Q3. Then, when the Hall Effect device turns off, D3 conducts and raises the voltage on the anode of Q2. Because of the 0.1μF capacitor connected to the anode, this also jacks up the voltage on the gate of Q2 which would otherwise be held at around 1.3 volts by the 220kΩ and 27kΩ resistors. Subsequently, the voltage at the gate bleeds away until, 0.9ms after the Hall Effect device turned off, the gate voltage has fallen to 0.6V below the anode. This causes Q2 to conduct and so remove the forward bias from Q3. This causes Q4 and Q5 to turn on again and thus current passes through the coil earlier than it otherwise would have without the dwell extension facility.

Breakerless ignition

The rest of the circuit operates the same as the original circuit which was fully described in the February 1983 issue.

The CDI version

As mentioned previously this version suits the CDI circuits described in August 1970 and July 1975 but it could probably be adapted to suit any CDI system which used a similar method for triggering the SCR.

As with the version for the Transistor Assisted Ignition, Q1 is a constant current source which supplies around 33 milliamps to the Hall Effect device and D3. When the Hall Effect device is off, D3 is not conducting and so Q2 is biased off as is Q3. When a south pole of the ring magnet moves away from the Hall Effect device it switches off and allows D3 to conduct. This turns on Q2 and Q3 and delivers a pulse of current to the gate of the SCR via the 0.22μF capacitor. This triggers the SCR into conduction.

For further information regarding the CDI circuit refer to the articles as previously mentioned.

Construction

As far as construction of these circuits is concerned, we have developed a PCB (code 83ti12, 93 x 69mm) for adapting the transistor ignition to Hall triggering. For the CDI conversion, we will leave it to readers to add on the extra circuitry using Veroboard or matrix board.

The new Transistor Assisted Ignition PCB is very similar to the previous PCB and is only modified for the input circuitry. Consequently, readers will find it easy to remove the components from the old PCB and place them on the new PCB without changing the lead spacings. Note the heat expansion and shock relieving loops in the diode leads.

Follow the parts overlay carefully, making sure that the polarity conscious components are oriented correctly. The mounting holes and wiring positions are the same as before so no wiring modifications will be necessary. Mounting details are the same as in the previous article.

Modifying the distributor

The Hall Effect device has been designed by Sparkrite to suit most vehicles with these distributors: Motorcraft or Autolite (4 and 6 cylinders), Bosch (all 4 cylinder), Lucas (4 and 6), AC Delco D202 and D204 (4 cylinder), Toyoto Nippondenso (4 cylinder), and Hitachi Datsun (4 cylinder).

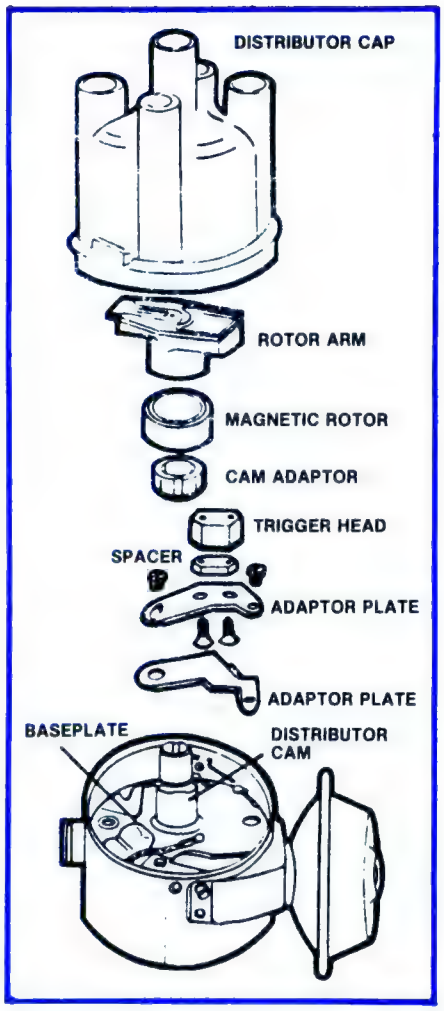
Each kit as supplied from Jaycar includes comprehensive installation instructions. Basically the installation is as follows. First, the contact breaker points and capacitor are removed from the distributor. This also includes a damping rubbing block which is used in some distributors opposing the contact points rubbing block. The grommet or screw connector for the contact points lead should also be removed.

Now the correct cam adapter and adapter plate should be selected, the correct type for the particular distributor being listed in the instructions. The 6-cylinder magnet has four keys to locate it on the cam adapter while the 4 cylinder magnet has three. Place the cam adapter over the cam and then the ring magnet, which holds the adapter tightly over the cam.

Note that for clockwise-rotating distributors the painted dot side of the magnet should face upwards. Conversely, the dot should face downward for anticlockwise rotating distributors. This is important since ignition timing will be incorrect if not adhered to.

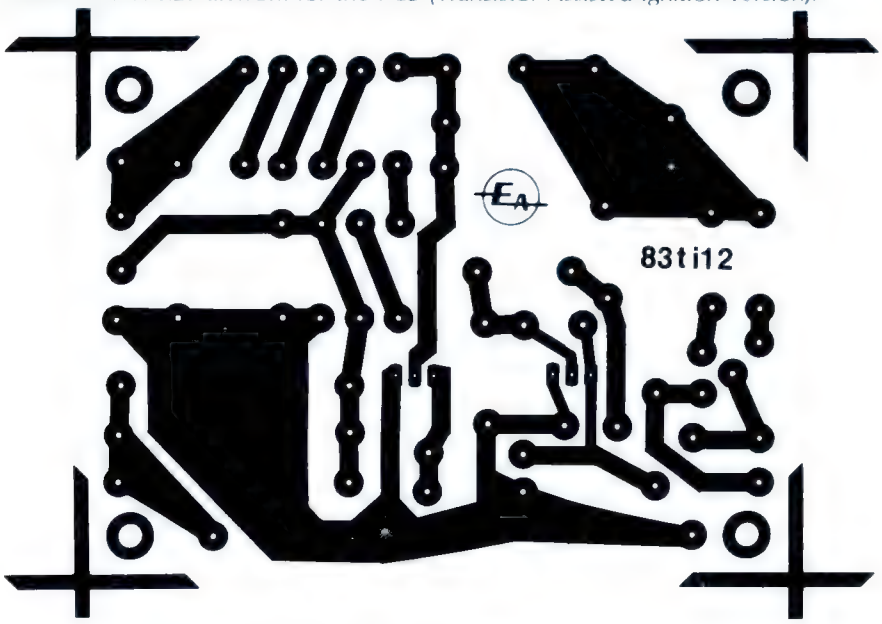
How the Hall effect sensor is placed into the distributor using the adapter plate and spacers. The spacers are used to adjust the height of the sensor so that the magnet and sensor are centred. The adapter plate allows adjustment of the sensor so that it is tangential to the magnet. Diagrams in the instructions show how this is done. Note also that the air gap between the magnet and sensor face should be around .015 inches or 0.4mm. This adjustment is usually only possible at one point of rotation of the magnet. Just make the gap small but not so small as to cause scraping at the closest point of rotation.

Note that the flexible earth lead must be reconnected.



Reproduced from the kit manual, this diagram shows how a typical distributor is adapted to Hall Effect triggering.

Below: actual size artwork for the PCB (Transistor Assisted Ignition version).



MITSUBISHI ELECTRIC

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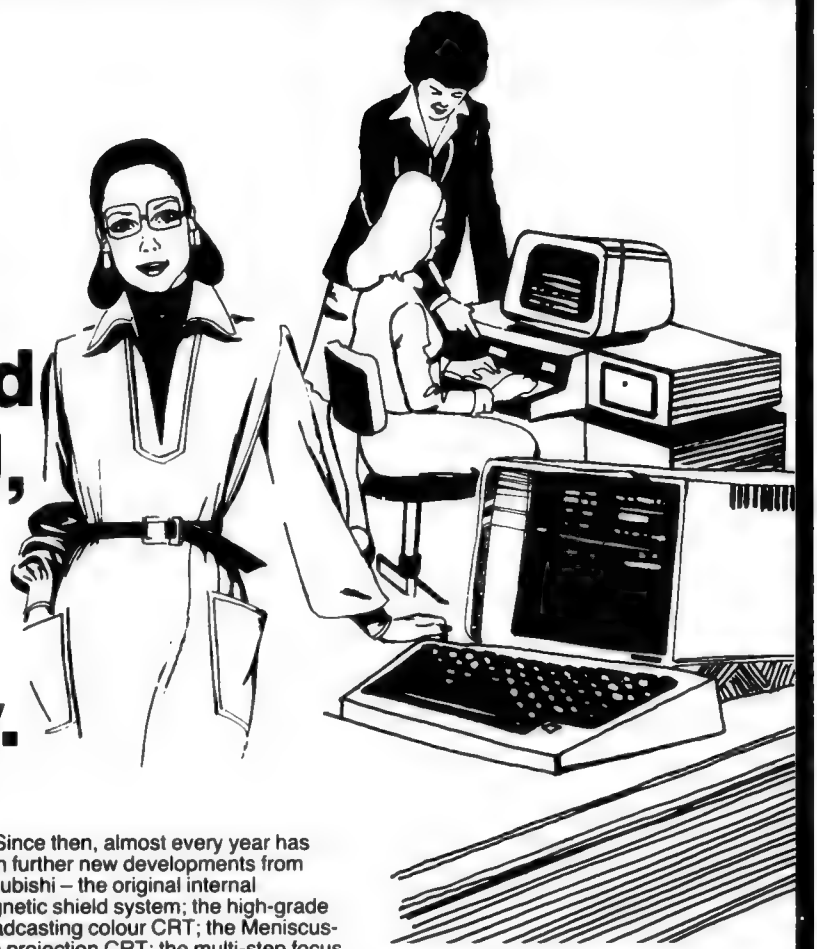

In this day and age, productivity and technology go hand in hand – the more advanced the tool, the higher the productivity.

So it is with monitors.

Today there seems to be a belief that because computers are high technology, there's little real difference between the peripherals. So buyers tend to buy on price alone.

But as we all know, lower price is seldom synonymous with higher quality.

Since 1972, Mitsubishi has led the world in video monitor CRT (cathode ray tube) development. In that year, they produced the world's first high resolution colour CRT. The following year, 1973, saw the development of the semi-toroidal self-convergence deflection-yoke system, and the long-persistence phosphor colour display screen.

Since then, almost every year has seen further new developments from Mitsubishi – the original internal magnetic shield system; the high-grade broadcasting colour CRT; the Meniscus-type projection CRT; the multi-step focus electron gun; the original arc-shield gun; the first anti-reflective coating – the list goes on. Yet despite this massive R & D investment, the price of a top quality Mitsubishi monitor is only a little bit more – and it could save you so much in the long term.

Mitsubishi monitors, both colour and mono, cased and uncased, are distributed in Australia by Nexus Electronics of Sydney; and Sycom of Melbourne, two companies dedicated to the pursuit of excellence. Their marketing and service support is second to none, anywhere in the world; which is precisely why they were chosen by Mitsubishi Electric, itself a company devoted to excellence in electronics.

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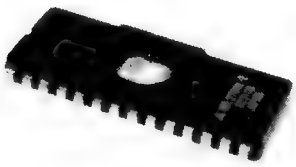

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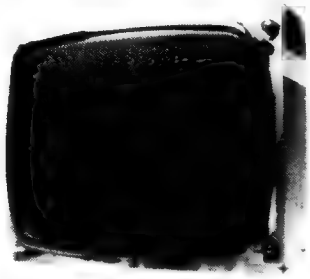

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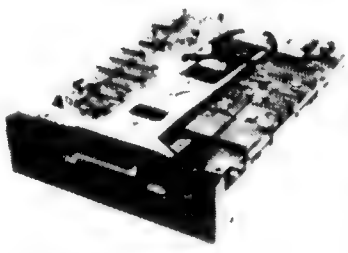

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Breakerless ignition

Now the lead from the Hall Effect device can be fed through a suitable grommet to the electronic ignition. In most cases, it should be possible to use the original grommet used with the points lead. The lead from the Hall Effect sensor can either be soldered directly onto the electronic ignition input, or you may prefer to use suitable plug-in connectors. Make sure that the lead from the sensor to the grommet has sufficient slack to allow for full vacuum advance.

Timing the engine initially can be difficult so we recommend this method. Simply connect the lead from the Hall sensor to the positive of the battery via a 220Ω resistor. Now connect a multimeter between ground and the Hall sensor lead. Rotate the distributor by rotating the engine by hand and watch the voltage reading on the meter. It should read about 4V when the south pole is activating the sensor and about 11 to 12 volts when the magnet has passed. This transition from low (4V) to high (11V) is the firing point.

Loosen the distributor and rotate it so that the transition from high to low occurs at the correct static ignition timing point for your vehicle. Note that the engine should always be fully rotated in the correct direction and not reversed when performing this timing. This is important since there is considerable hysteresis in the Hall Effect sensor and you are likely to find the wrong firing point if you reverse the engine and then bring it forward again.

When the firing point is correct, check that the rotor arm is facing the relevant cylinder position (usually cylinder 1) on the distributor cap, or the timing mark for number 1 cylinder on the distributor body. The distributor should only have to be moved slightly from its original position. The rotor arm should now be located so that, at maximum and minimum settings of vacuum and centrifugal advance, the distributor cap contact is always located within the range of the rotor arm.

If this is not the case and you find the rotor arm positioned between two adjacent distributor cap contacts, then the Hall adapter plate will have to be modified so that firing occurs at the correct point. Clamp the sensor with a small G-clamp and position the distributor so that the centre of the rotor arm is opposite the appropriate distributor cup contact. Now move the Hall sensor so that the device goes from low to high at this firing point.

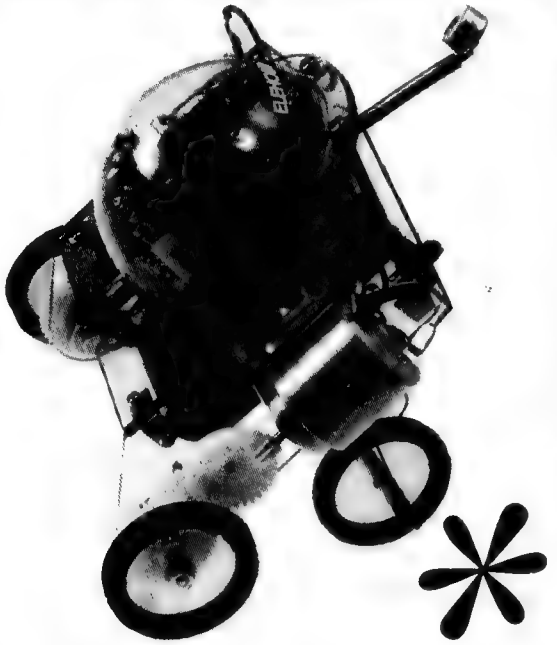
A bracket can now be made to support the sensor in this position. Alternatively, holes can be directly drilled in the advance plate to locate the sensor.

Finally, the engine should be dynamically timed according to the procedure in the workshop manual.

This circuitry is all mounted in a metal diecast case measuring 118 × 93 × 56mm. A finned heatsink is essential for transistors Q4 and Q5.

Special Annoucement

Jaycar Electronics is proud to announce a range of very low cost "Turtle" like robot kits. Don't let the low prices fool you – they are not toys.
The units feature solderless connections with explicit illustrations to ease assembly. Only simple tools (i.e. screwdriver, pliers etc.) are needed to assemble.



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Note: The "Microbots" work well on their own but can also be used as a platform for robotic development. If you are a robot experimenter you will find them useful as they help resolve the mechanical parts problem.

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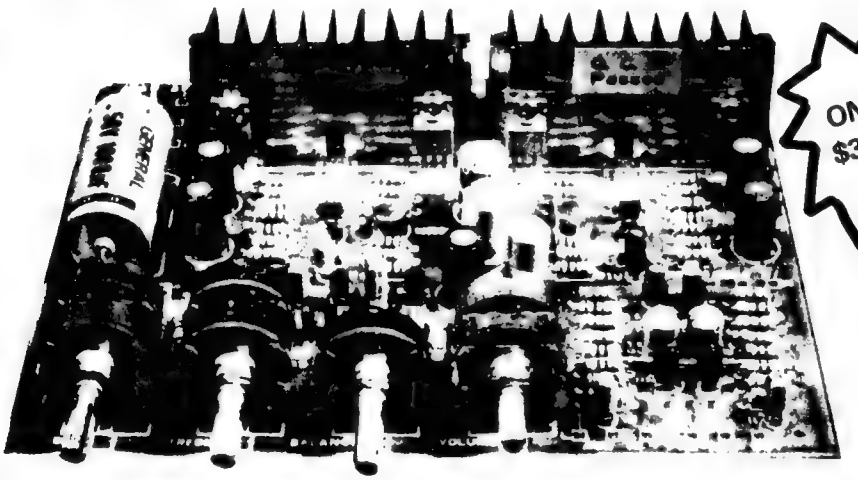

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(not illustrated)

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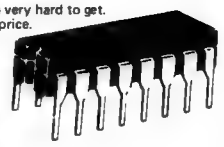

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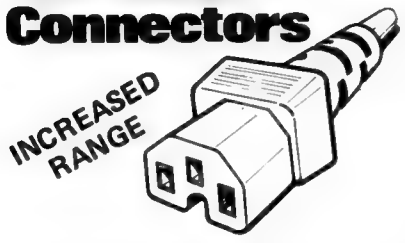

Most imported equipment these days now uses IEC-320 style AC power inlet connectors. Indeed, the electronics mags will soon be specifying these connectors on many of their mains-powered projects to simplify (and therefore make safer) mains wiring. Jaycar now stocks a range of ELECTRICITY AUTHORITY APPROVED mains line cords. We have them in straight entry, left and right entry with and without standard 240V mains moulded plug. Each cord is a generous 2 metres long and is rated at 7.5 amp continuous.

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DESIGN FEATURES
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Resistance	200Ω	100mΩ	0.5% - 1 digit
	20kΩ	10Ω	0.5% - 1 digit
R P M	20 000r p m	10r p m	1% - 3 digits
Dwell	90	0.1	2% - 3 digits

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Easy-to-build electronic game

Chase 'N' Chomp

by JOHN CLARKE

Emulating a popular gobble-em-up video game, Chase 'N' Chomp is a hand-held electronic version that will bring hours of enjoyment. Using novel bi-colour LEDs and simple sound effects, the game should prove popular with young and old alike.

No game is valued if it represents little challenge, is predictable and takes no account of a skilful player. With this game you can expect to lose. "Chase 'N' Chomp" is not easy to play. It requires considerable skill, quick reflexes, cunning and a degree of luck. The game also contains an element of surprise due to the unpredictable movements of the game opponent.

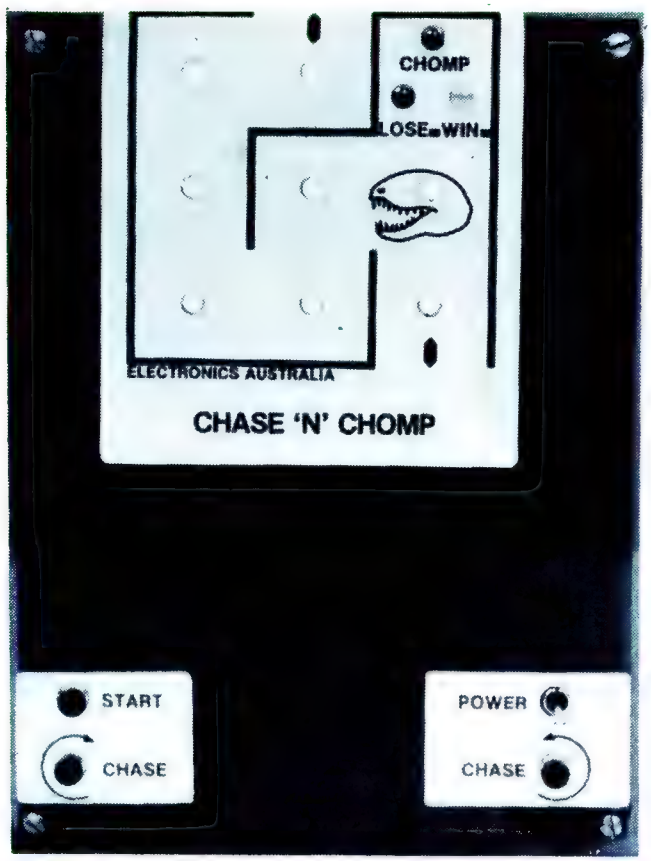
Physical layout of the game can be seen in the photographs. Eight bi-colour LEDs are arranged in the maze pattern and, in addition, three LEDs are located in the top right hand corner. Two indicate a win or loss of the game while the third indicates "chomp". Four switches are used: an on/off switch, a start switch which restarts play after each game is completed, and two chase switches which allow opponent attack in either the clockwise or anticlockwise direction.

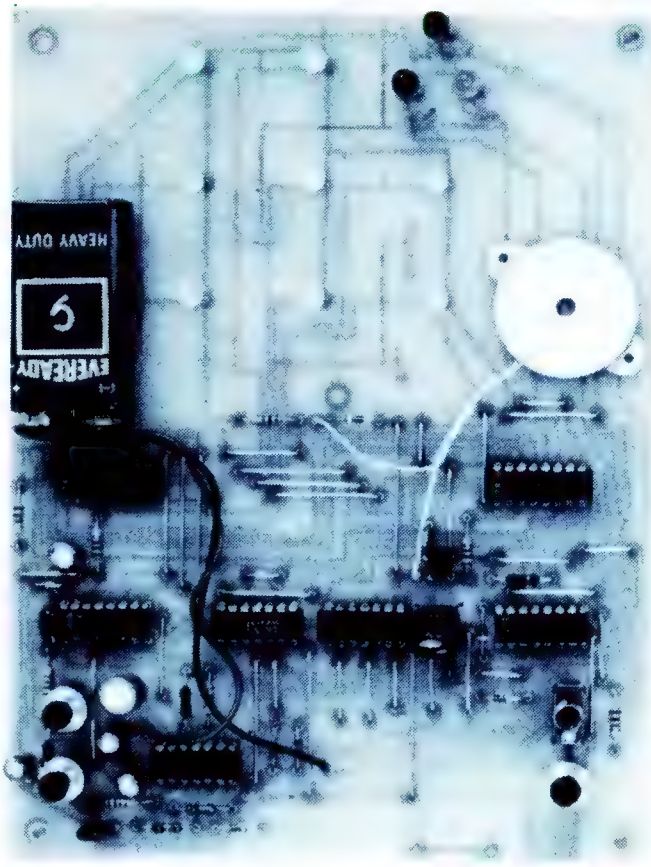
Upon pressing the start switch, one of the bi-colour LEDs will appear red in one position on the playing field. This is the opponent. A second bi-colour LED will also appear in a different position and this will alternate between green and red at about a one second rate. This is the player.

The object of the game is to "chomp" your opponent before it chomps you. This involves landing on your opponent; in other words occupying the same LED space. It is possible to chomp your opponent while your playing LED is either green or red, but to win, as indicated by a flashing win LED, the player LED must be green at the time of chomping. Accordingly, it is necessary to coordinate your move to chomp your opponent when the player LED is green or a "lose" will be indicated. In other words, don't try to chomp your opponent while it has its little red mouth open!

The chase control switches allow movement of the player LED. The clockwise chase switch moves the player in a clockwise direction through the maze pattern. Similarly, the anticlockwise chase switch moves the player in an anticlockwise direction through the maze. To increase player difficulty, the chase switches are rendered ineffective unless the chomp LED is lit. Pressing a chase switch before the chomp LED lights will only delay your chance to move.

While you are moving your player, the opponent is not idle. In fact the opponent is quite crafty and, although restricted to moving within the maze, can move rather spasmodically. Sometimes, he will even reverse direction to pounce upon and chomp the player. The game is over and a flashing lose LED indicates the player's





Two stages of construction: completed unit (left) and view of assembled PCB (right).

Fig. 1 (right) shows several different ways of driving the bicolour LEDs while Fig. 2 (below, right) shows the basic scheme for the Chase 'N' Chomp circuit.

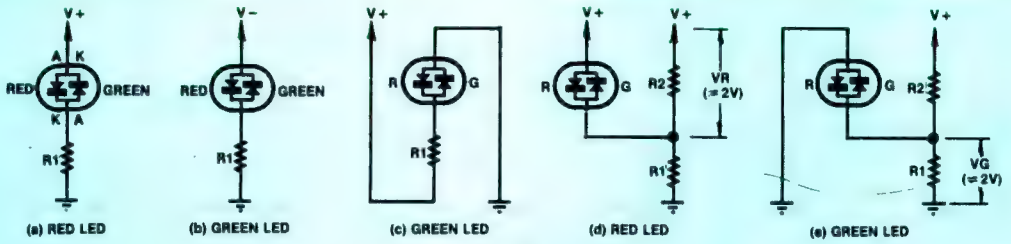


Fig. 1

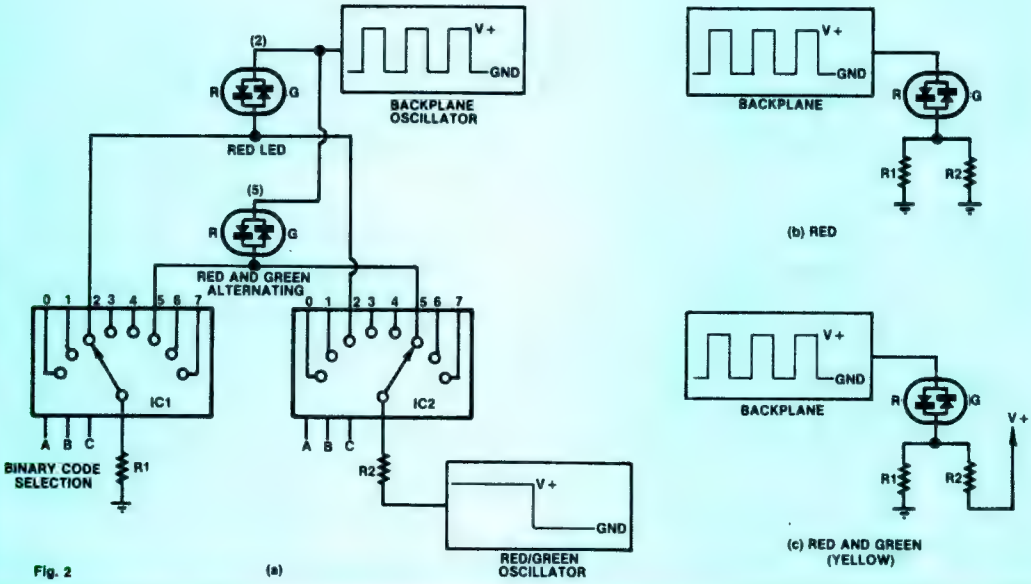


Fig. 2

We estimate the current cost of components for this project to be approximately

$30

This includes sales tax.

Chase 'N' Chomp

doom. In all cases, if the opponent is allowed to attack, the game will be lost.

Sound effects are simple, providing only a tone for the playing LED. The sound is similar to an ambulance siren, promoting a sense of urgency to the game. Scoring has not been included as it would make the game too expensive.

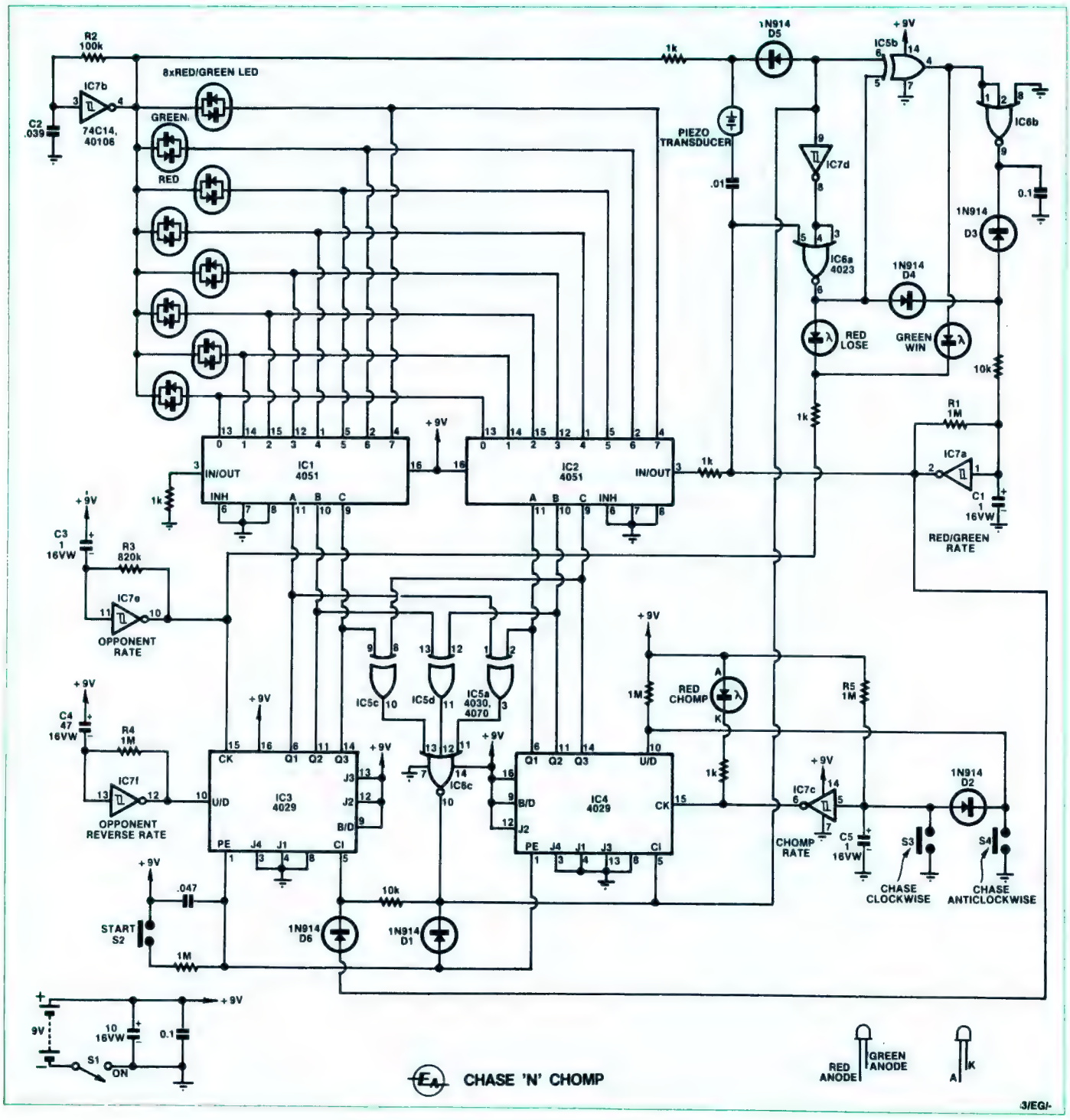
Bi-colour LEDs

Well that describes how the game is played. Now let's see how the game operates.

Externally, bi-colour LEDs are similar in appearance to a normal single-colour LED, with two leads and a frosty white package. Internally, they contain two reverse connected LEDs of contrasting colours. Applying a current of between 5 to 30mA in one direction will light one LED while current in the reverse direction will light the other LED. Fig. 1 shows several ways of driving the LEDs.

Fig. 1a shows the circuit for lighting the red LED. This simple circuit can also light the green LED if its cathode is taken to a negative supply as shown in Fig. 1b. For a single supply, it is necessary to swap both the ground and positive connections to light the green LED as in Fig. 1c.

Another technique for lighting both the red and green LEDs using a single supply is shown in Figs. 1d and 1e. This requires the use of two resistors, R1 and R2, and has the advantage that only one side of



the LED package must be connected to the ground or positive supply. When the red LED is lit (Fig. 1d), the current is limited by R1, while the voltage drop across R2 will be the voltage drop across the red LED (typically around 2V).

A similar situation applies to Fig. 1e except that, in this case, the current is limited by R2, a voltage drop of around 2V is developed across R1, and the green LED is lit.

Note that a yellow light can be obtained by applying AC to the device. This lights both the red and green LEDs alternately so that the two colours are mixed in the eye to give yellow.

Fig. 2a is a simplified block diagram of the bi-colour LED driving circuit for our game. Note that only two of the eight LEDs used are shown for clarity. IC1 and IC2 are 8-channel multiplexers and these are shown as single pole 8-position switches. A three bit binary code applied to inputs on the multiplexers allows selection of each switch position. For IC1, the common or pole connection is permanently tied to ground via R1. The common of IC2, however, is tied to the red/green oscillator which alternately connects R2 to ground and the positive supply rail.

The backplane oscillator produces a 150Hz signal swinging from the positive supply rail to ground. When it is at the positive rail, LED 2 will be red. LED 5 will also light red when the red/green oscillator is at ground. When the backplane oscillator is at ground, LED 5 will light green provided the red/green oscillator is at the positive rail. LED 2 will be off.

Since the backplane oscillator is relatively fast, and due to the persistence of vision, LED 2 will appear to be continuously on and glowing red. LED 5 will alternate between red and green at the red/green oscillator rate.

To light other LEDs, all that is required is a differing code applied to the multiplexers to access the new switch position.

Circuit details

Although the circuit may at first appear daunting, it can be made simple by dividing it into subsections. IC1 and IC2 are the two central ICs depicted in Fig. 2. These have A, B and C inputs to select the switched outputs from 0 to 7. If, for example, inputs A, B and C are grounded, then output 0 is selected. If they are all taken to the positive rail then output 7 is selected.

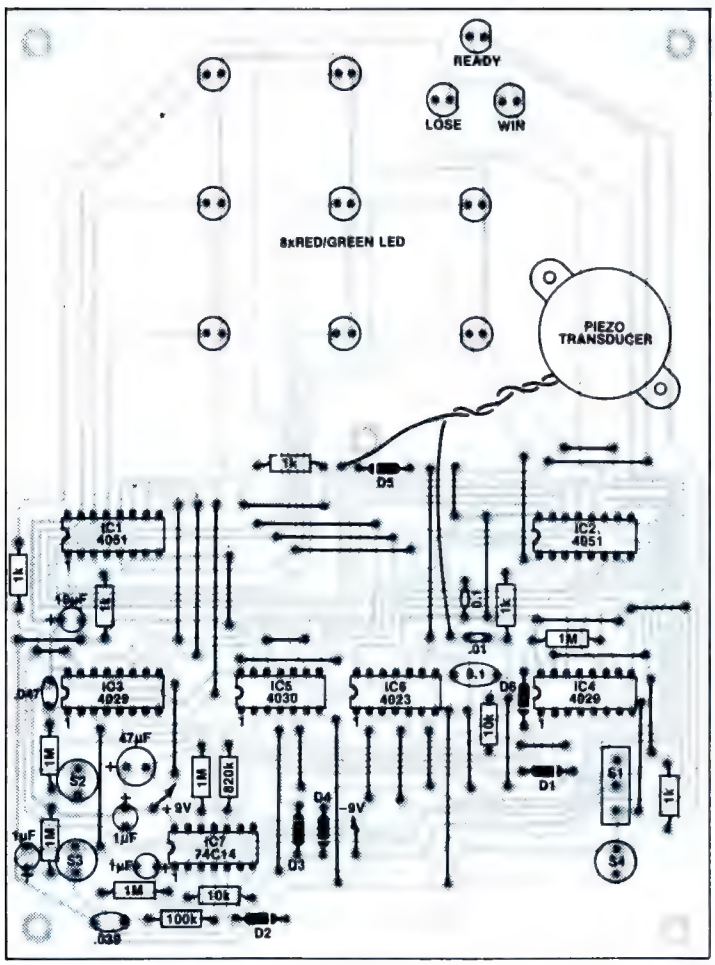
IC7b forms the backplane oscillator, which is also depicted in Fig. 2. This oscillator is formed by a 74C14 Schmitt trigger, a 100kΩ resistor (R2) and a .039μF timing capacitor (C2). Operation of the Schmitt trigger is as follows.

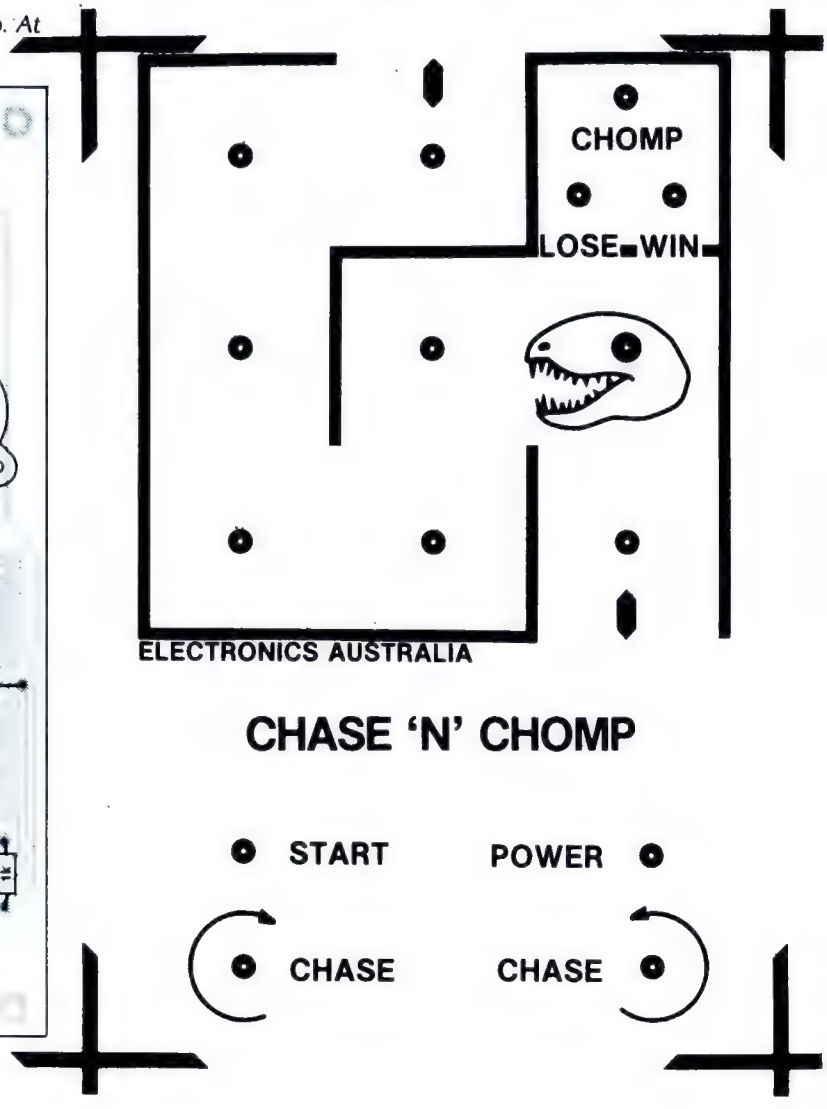
Initially, C2 is discharged and so the output of IC7b is high. C2 now charges via R2 until the voltage reaches the upper threshold point of the Schmitt trigger. The output of IC7b then goes low and C2 discharges via R2. When the voltage on C2 reaches the lower threshold of the Schmitt, the output goes high again and the cycle repeats.

Incidentally, some readers may question our use of the term "backplane" which is usually confined to the common electrode in a liquid crystal display. Plainly there is no equivalent in the Chase 'N' Chomp circuit but the backplane oscillator performs a similar function in providing a common line upon which is superimposed an AC signal.

The in/out common connection of IC2 is connected to the output of the red/green rate oscillator via a 1kΩ resistor. This oscillator is formed by

Below: PCB parts overlay diagram for the Chase 'N' Chomp. At right is the actual size front panel artwork.





Chase 'N' Chomp

Schmitt trigger IC7a and its associated 1MΩ feedback resistor (R1) and 1μF timing capacitor (C1). Frequency of operation is approximately 1Hz.

Two up/down presettable counters, IC3 and IC4, are used to control the IC1 and IC2 multiplexers. These provide binary codes to the A, B and C inputs and thus determine which of the multiplexer outputs are internally connected to the in/out pin (pin 3). The up/down capability of the counters allows us to direct the LEDs to turn on in the up sequence (clockwise from 0-7) or turn on in the down sequence (anticlockwise from 7-0).

At each positive-going clock input to a counter, its binary outputs, Q1 to Q3, increment or decrement to the next count number. This is decoded by the corresponding multiplexer to light the adjacent LED. IC1 and IC3 form the opponent section of the LED circuit with IC3 clocked at a 1Hz rate by Schmitt trigger oscillator IC7e. This opponent rate oscillator increments the count of IC3 only when the pin 5 carry-in (CI) input is low. The carry-in signal can thus be regarded as a clock enabling signal.

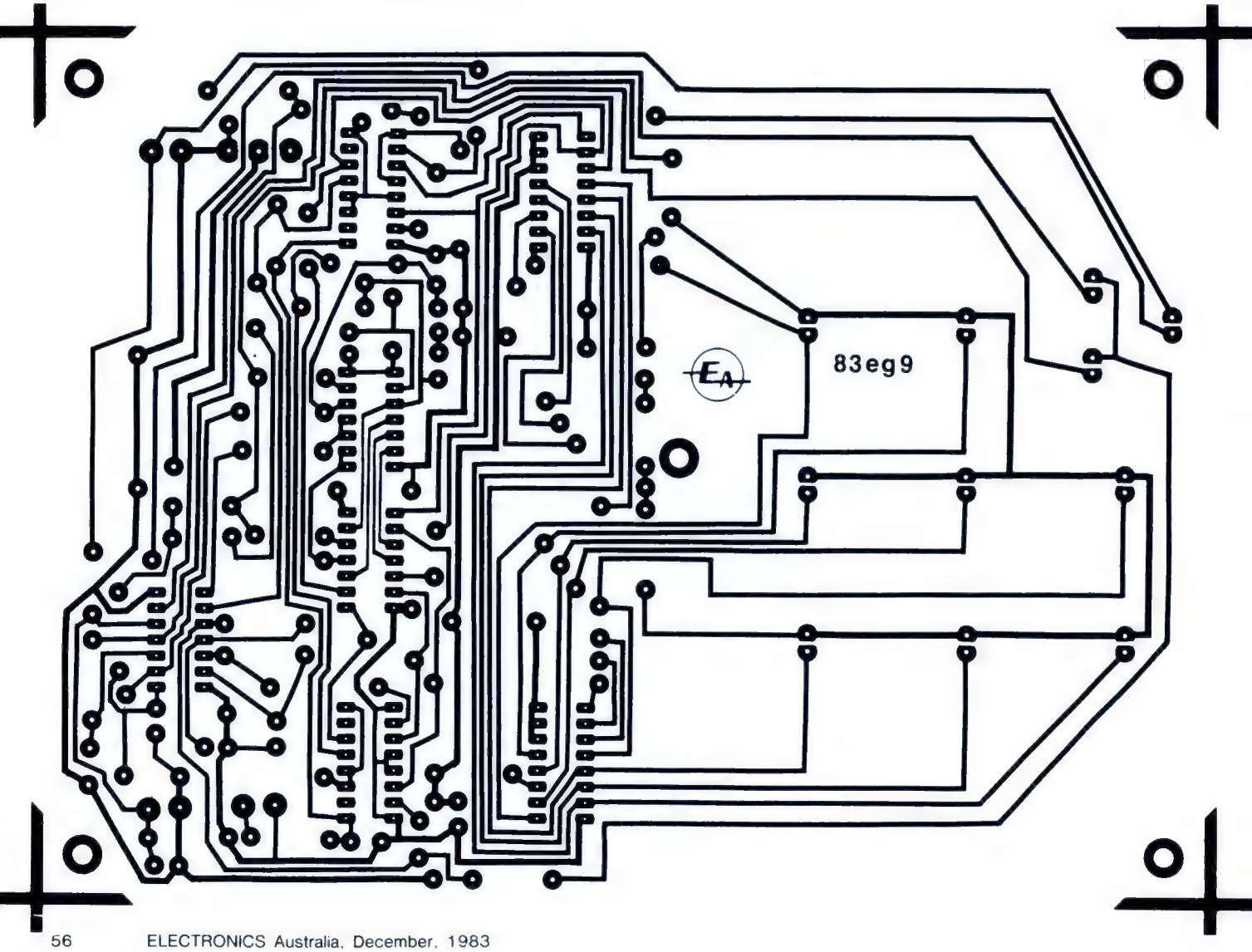
The output of the red/green oscillator (IC7a) is fed to the CI input of IC3 via diode D6. When the CI input is high, the player LED is green and no clocking can occur in IC3. This ensures that the opponent LED can only move when the player LED is red (ie, when the red/green oscillator is low). Two results flow from this: (1) because clocking of IC3 depends on the phase relationship between IC7a and IC7e, the opponent LED moves spasmodically; and (2) the opponent always loses if the opponent moves to chomp.

IC7f, also a Schmitt trigger oscillator, oscillates very slowly and determines whether IC3 counts up or down. This reverses the direction of the opponent LED. When the output of IC7f is high the counter counts up and consequently the red opponent LED travels clockwise. When the output is low the counter counts down and the LED travels anticlockwise.

Clocking and up/down operation of IC4 is carried out manually and is considerably different to that for IC3. Under normal conditions, capacitor C5 at the input to Schmitt trigger IC7c is charged to the positive rail via R5 and so the output, pin 6, of IC7c is low. The chomp LED is therefore lit. The up/down input is tied high via a 1MΩ resistor. When the chase clockwise switch is pressed, C5 is discharged and the clock input of IC4 goes high, incrementing the counter. The chomp LED is now off since the Schmitt output is high.

When the switch is released, C5 begins to charge. After about one second the capacitor voltage reaches the upper trigger point for IC7c and the output goes low, relighting the Chomp LED. The

Below is an actual size artwork for the PCB pattern.



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Chase 'N' Chomp

chase anticlockwise switch operates in a similar manner to the chase clockwise switch with the exception that the up/down input of the counter is pulled low with the closing of the switch. This decrements the counter. Diode D2 isolates this pull-down function of the up/down input from the chase clockwise switch.

There will always be a wait of about one second after release of a chase switch before the chomp LED lights and counter IC4 can be reclocked. Pressing a chase switch before the IC7c Schmitt trigger goes low again will discharge C5 without clocking IC4.

Detection of the end of game, whether it be a win or lose, is carried out by exclusive OR (XOR) gates IC5a c, and d, and by a three-input NOR gate IC6c. End of game occurs when both the player and opponent LEDs occupy the same position. This means that there will be the same binary count on both IC3 and IC4. XOR gate IC5a checks for the same logic level from the Q1 outputs of IC3 and IC4, while IC5d and IC5c check the Q2 and Q3 outputs respectively.

XOR gates operate such that the output is high when the inputs are different and low when they are the same. Consequently, when the same count is on both IC3 and IC4, all XOR gate outputs will be low, but at least one will be high if IC3 and IC4 have different counts.

The NOR gate (IC6c) operates such that its output will be high only when all inputs are low. Consequently, pin 10 of IC6c goes high only when IC3 and IC4 have the same count.

This high from IC6c brings the carry in, CI, high on both counters which then stop counting clock pulses. As a result, the game remains latched with both the opponent and player LEDs at the same position at the end of a game.

It is now necessary to detect either the "win" (green LED, IC7a high) or "lose" (red LED, IC7a low) situations so that we know who won the game.

Since we know that a "lose" occurs when the red/green oscillator is low and that a win occurs when the oscillator is high, we can determine the win or lose condition after IC6c goes high. IC7d inverts the high from IC6c and this sets the output of IC6a, wired as a two-input NOR gate, high if IC7a is low and low if IC7a is high. Consequently, when high, the lose LED will light. When low, the output of XOR gate IC5b will be high and the win LED will light.

The cathodes of the win and lose LEDs are connected to the opponent rate oscillator, IC7e, via a 1kΩ resistor. The win and lose LED will thus flash at a 1Hz rate.

At the end of the game, it is necessary to halt the red/green oscillator so that the win or lose state will remain. This is done using diode D4 if the game is lost and diode D3 if the game is won. As explained previously, when the game is lost the output of IC7a (pin 2) will be low while the output of IC6a will be high. At the same time, diode D4 pulls the input to IC7a high via a 10kΩ resistor, thus stopping the red/green oscillator in the low state at which the game ended.

For the win situation, the outputs of IC7a and IC5b are both high. In this case, however, the output of IC5b is inverted by IC6b and IC7a is stopped by pulling its pin 1 input low via diode D3.

The game is now left in a state where the win or lose LED is flashing on and off and the player and opponent LED remains in the position where the game

PARTS LIST

1 PCB, code 83eg9, 138x186mm
1 Perspex sheet, 138x186mm
1 Scotchcal label
8 bi-coloured LEDs (Soanar SPRG511 red/green)
2 5mm red LEDs
1 5mm green LED
3 momentary contact pushbutton switches
1 SPDT toggle switch
1 9V battery (type 216)
1 battery clip for 216 9V battery
1 piezoelectric transducer (Toko PB-2720 or equivalent)
4 15mm standoffs
4 25mm machine screws and nuts
4 rubber feet

SEMICONDUCTORS
2 4051 8-channel analog multiplexers
2 4029 presettable up/down counters
1 4030, 4070 quad 2-input exclusive OR gate
1 4023 triple 3-input NAND gate
1 74C14, 40106 hex Schmitt trigger
6 1N914, 1N4148 diodes

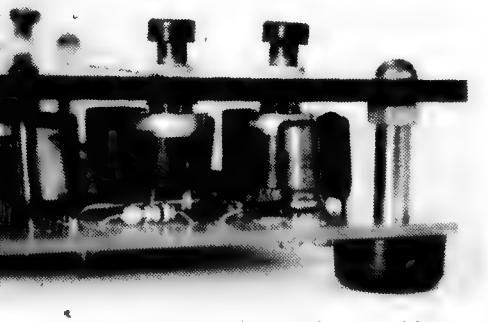
CAPACITORS
1 47µF/16VW PC electrolytic
1 10µF/16VW PC electrolytic
3 1µF/16VW PC electrolytic
2 0.1µF metallised polyester
1 .047µF metallised polyester
1 .039µF metallised polyester
1 .01µF metallised polyester

RESISTORS (5%, ¼W)
5x1MΩ, 1x820kΩ, 1x100kΩ, 2x10kΩ, 5x1kΩ

was won or lost. In the case of a win, both red and green LEDs will light and appear yellow. For a lose, only the red LED will light.

To restart the game, the start switch is pressed to bring the preset enable (PE) pins of IC3 and IC4 high. The preset enable allows the binary code set by the jam inputs, J1 to J4, of IC3 and IC4 to be loaded into the Q1 to Q3 outputs of the counters. For IC3, J1 and J4 are low and J2 and J3 are high. This sets multiplexer IC1 to the 6 output. For IC4, only J2 is high and IC2 is set to the 4 output.

Upon pressing the start switch, the voltage at the PE input does not rise immediately but is delayed by the 1MΩ resistor and .047μF capacitor. Due to slight differences in the characteristics of IC3 and IC4, one IC will preset the jam



View showing how the pushbutton switches are mounted.

inputs before the other. As soon as this happens, IC6c goes low (since the player and opponent LEDs now occupy differing locations) and pulls the PE inputs low via D1. This prevents the slower IC from preloading.

This racing effect provides some randomness in the positioning of the LEDs at the beginning of the game. Note that since the PE pins are only held low at the end of the game via the charge on the .047μF capacitor, the game will eventually restart itself when the capacitor discharges due to leakage.

Sound effects are provided by a piezoelectric transducer, one side of which is connected to the output of the backplane oscillator (IC7b). The other side of the transducer is connected to the red/green oscillator (IC7a) so that a slightly different tone occurs for the red and green LEDs. Diode D5 turns off the sound effects at the end of the game by shunting the signal from the backplane oscillator to the positive rail.

The reason for the change in tone is that the red and green LEDs draw different currents and this affects the supply to the backplane oscillator and hence its frequency. In addition, the voltage swing across the transducer will vary slightly, depending upon which section of the LED is on.

Power for the circuit is derived from a 9V type 216 battery with on/off switching provided by S1. A 10μF electrolytic capacitor and a 0.1μF metallised polyester capacitor provide supply rail decoupling.

Construction

All components for the game are mounted on a printed circuit board (PCB) coded 83eg9 and measuring 138x186mm. We used a 138x186mm perspex sheet supported on 15mm standoffs to cover the PCB, and this supports the LEDs and switches. A Scotchcal label is used to depict the maze and the switch and LED functions.

Begin construction by marking out and drilling the various holes for the LEDs, switches and corner mounting screws in the perspex sheet. The locations for these holes can be easily found – just use the PCB as a template. Holes for the LEDs are drilled to 5mm, while the corner holes and switch holes are drilled to 3mm and 7mm respectively.

The Scotchcal label can now be attached to the perspex panel. Cut the label into three sections as shown in the photographs and drill small pilot holes (1mm) at the positions indicated. Peel away the backing paper and carefully attach the label to the perspex, making sure that the various holes are correctly aligned. Finally, use a sharp knife or reamer to enlarge the holes in the Scotchcal material to the correct size.

Attention can now be turned to the PCB assembly. Follow the layout diagram when mounting the parts and take particular care with polarised components. Install the wire links first, then the resistors, diodes, capacitors and ICs in that order. Note that the ICs are CMOS devices, so the usual precautions apply: earth the barrel of your soldering iron to the earth track on the PCB using a small clip lead, and solder the power supply pins (7 and 14 or 8 and 16) first.

Next, the battery clip and the transducer can be wired into circuit, but make sure that you get the battery clip leads the right way round. The transducer is non-polarised so it does not matter which way you connect it. We used double-side tape to secure the battery and transducer to the PCB.

The switches are installed directly on the PCB and are soldered right at the ends of their leads. This done, insert (but do not solder) all the LEDs into their respective mounting holes and attach the perspex panel to the PCB using 15mm spacers and machine screws and nuts. These same machine screws are also used to secure a rubber mounting foot at each corner of the PCB.

Finally, position the LEDs so that they protrude slightly through the front panel and solder their respective leads.

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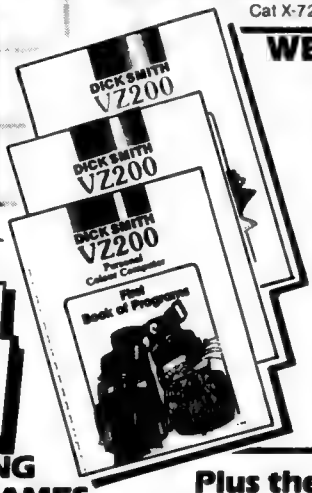

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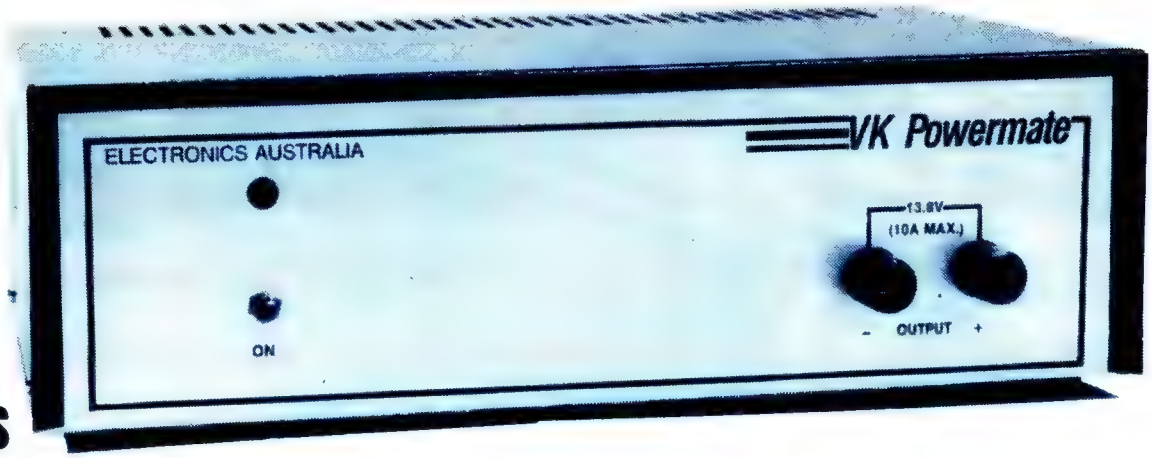

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VK Powermate

by COLIN DAWSON

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Typical amateur equipment likely to need a power supply such as described here would be higher output – 25 to 30 watt – two-metre transceivers, or one of the lower output – 10 watt – models driving an "afterburner" (RF power amplifier) possibly designed to deliver 40 to 50 watts. This latter arrangement can be particularly demanding.

Faced with the need to power such equipment, many an amateur resorts to a 12V battery discarded from the family car, connected across some form of "trickle" charger. There are a number of disadvantages to this method. The battery requires periodic maintenance, poses a hazard to other equipment by virtue of its acid electrolyte, has a limited life expectancy, and will not maintain an output of 13.8V under load. There is also a very real risk of introducing significant hum into the signal – and being chipped

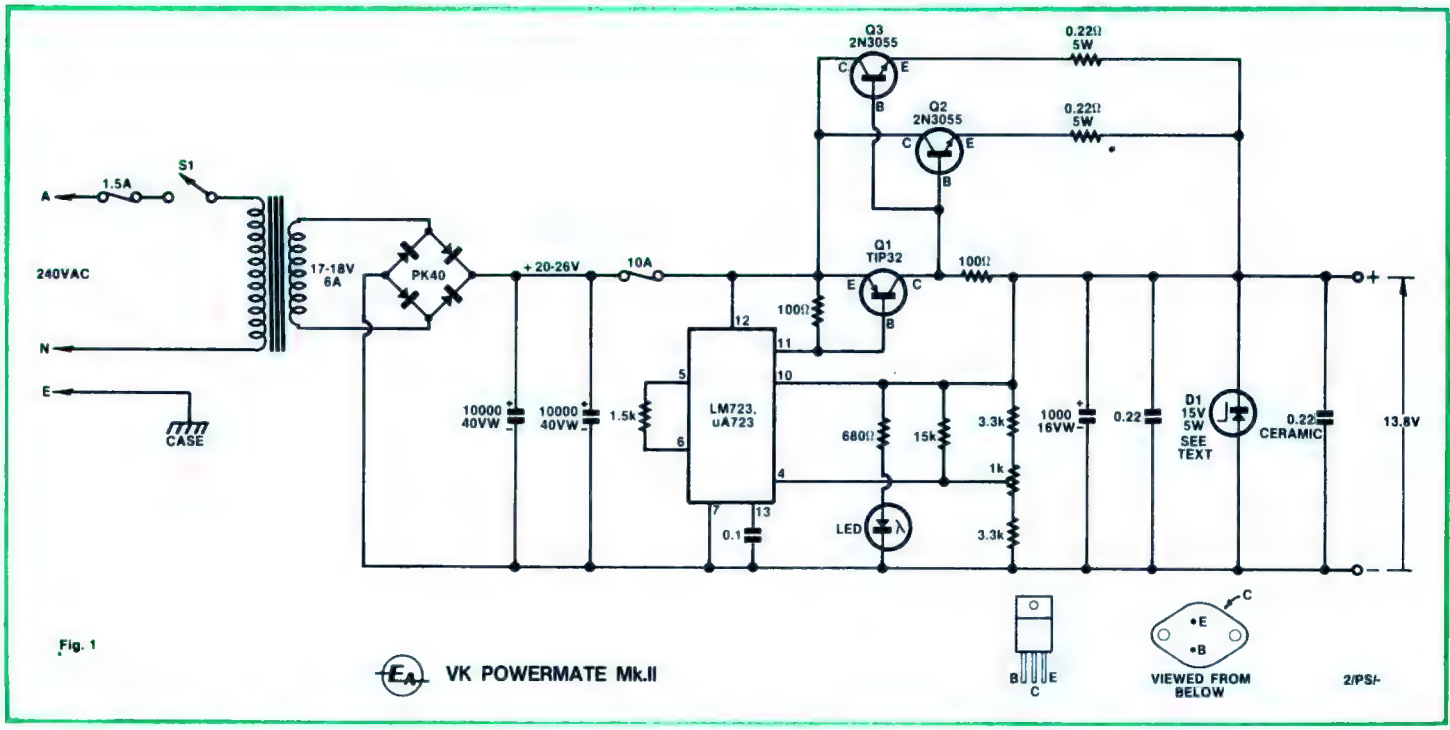
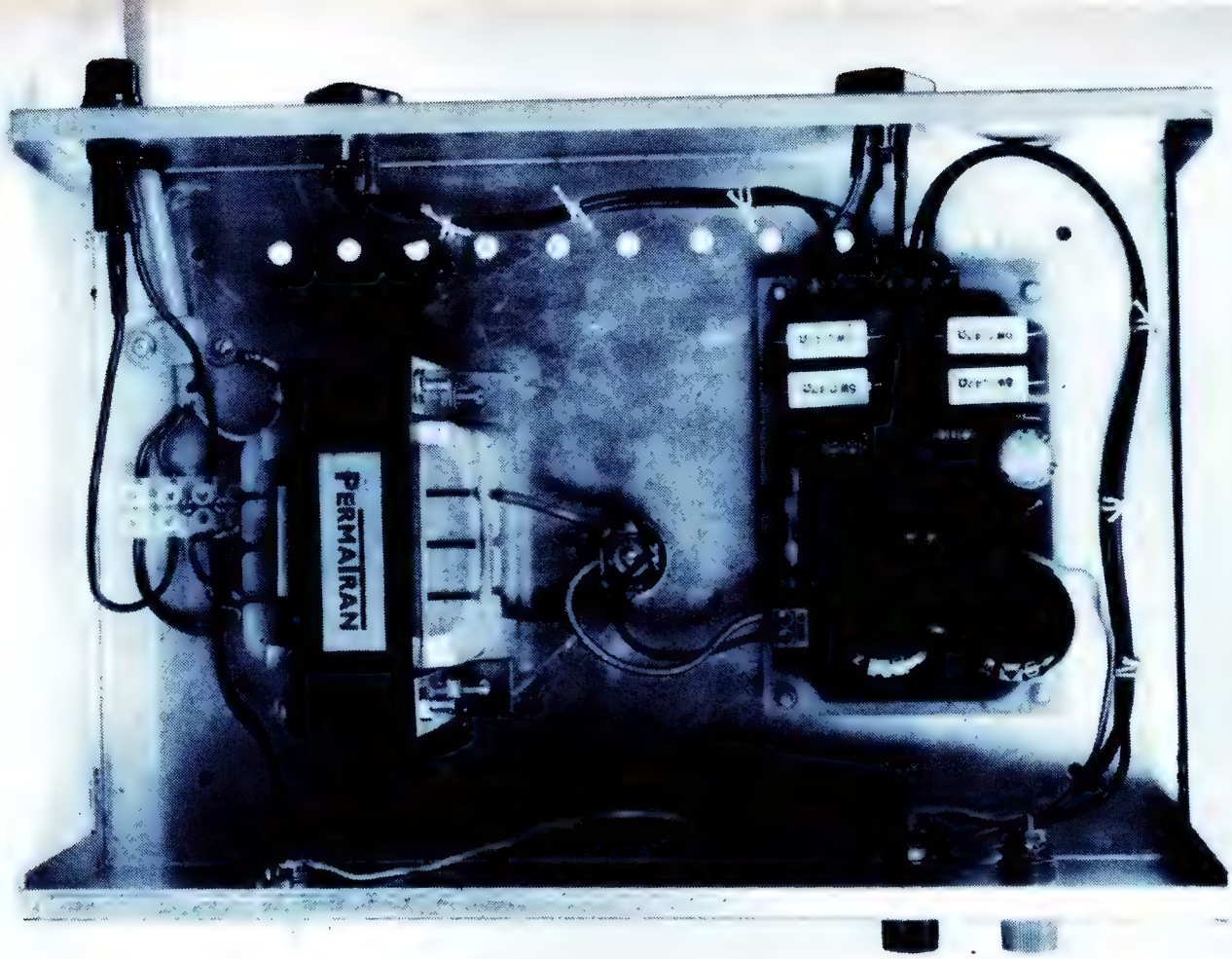


Fig. 1

VK POWERMATE Mk.II



View inside the prototype. Note the row of holes drilled in the chassis to promote air flow.

about it by one's fellow amateurs! This project overcomes those problems.

A voltage of 13.8V is now a well established design figure, the majority of transceivers being rated to give maximum RF output at this figure. Originally, transceivers of this type were designed primarily for use in cars where a nominal 12V supply is available from the battery.

However, since the electrical system in a car normally runs at between 13 and 14 volts, the transceiver manufacturers long ago decided to rate all their equipment for about 13.8V. This enables considerably more power to be achieved, as much as 20% more, than would be available if the rating was exactly 12V.

Design details

This design is an upgraded version of the May 1978 unit, the main aim being greater current capability. The previous design had a current limit of about 5A continuous, the main limiting factor being the 2N3055 output transistor.

In this version we have duplicated the output stage, ie, two 2N3055s in parallel, providing up to twice the current rating with suitable heatsinking. But that is not the same as saying that we automatically get 10A out of the system. Other factors now limit the current rating.

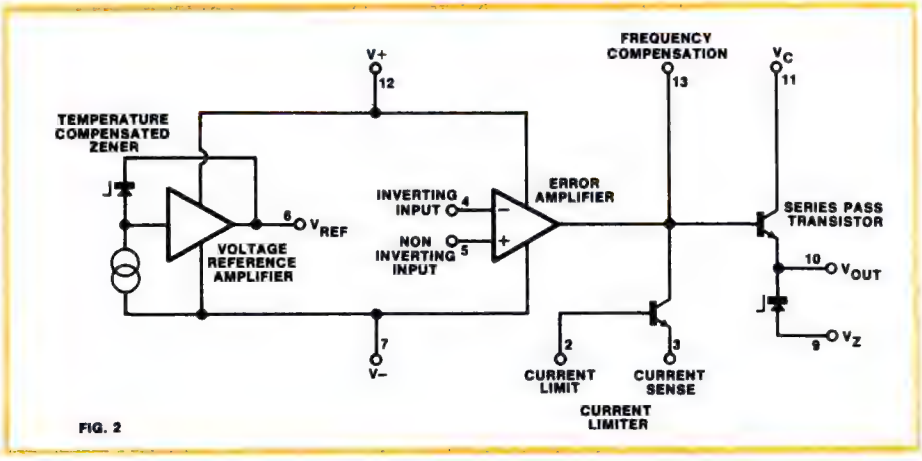


FIG. 2

One is the transformer. This is the same model as used in the original, and has a continuous rating of 6A, so this must be regarded as the maximum continuous rating. But the transformer can deliver more on an intermittent basis – such as when used in an amateur role – and it should be quite practical to run it up to about 8.5A under typical 50% duty cycle conditions.

If it was desired to run 8.5A continuously, two changes would have to be made: a transformer with at least this continuous rating and more substantial heatsinking, such as moderately large finned heatsinks, for the output transistors.

Beyond 8.5A, even assuming the above modifications, the circuit will cease to regulate, due mainly to the limitations of the power transformer, rectifier, and filters, and their inability to maintain enough input voltage to overcome the losses in the rest of the system. Thus the output voltage would fall, though not significantly up to about 10A. But this must be regarded as the absolute maximum for this circuit.

As already implied, we can avoid the need for "add-on" heatsinks for current up to about 6A continuous. The metal K&W case has a large enough surface area to dissipate most of the heat generated by the output transistors. The ventilated cabinet also allows heat from

VK Powermate

other components to escape (this case is available from several retailers).

As a further refinement to the original design, we have used PC board-mounting terminal blocks. These connectors have only recently become available and are used to replace PCB pins. Previously, we have used solder lugs bolted to the board for heavy current connections, the main reason being to avoid the use of PCB pins – they are not really adequate to support heavy wiring.

The new terminal blocks are available in even multiples from 2 to 12. We have used a two-way and an eight-way and this takes care of all the wiring to the printed circuit board. Four and eight-way blocks are available from Jaycar, and Avtek sell the full range.

Apart from the provision of fuses, the VK Powermate does not have short-circuit protection. Our first prototype did have a "foldback" current-limiting characteristic, which gives reduced power dissipation under short-circuit conditions, compared with a simple current-limit characteristic. Unfortunately, the line regulation was found to be inadequate so we discarded the current limiting feature.

The circuit is based on the 723 regulator integrated circuit. This was originally introduced by Fairchild as the uA723, second-sourced by National Semiconductor as the LM723 and produced by other manufacturers with similar "723" designations.

We estimate that the current cost of parts for this project is approximately

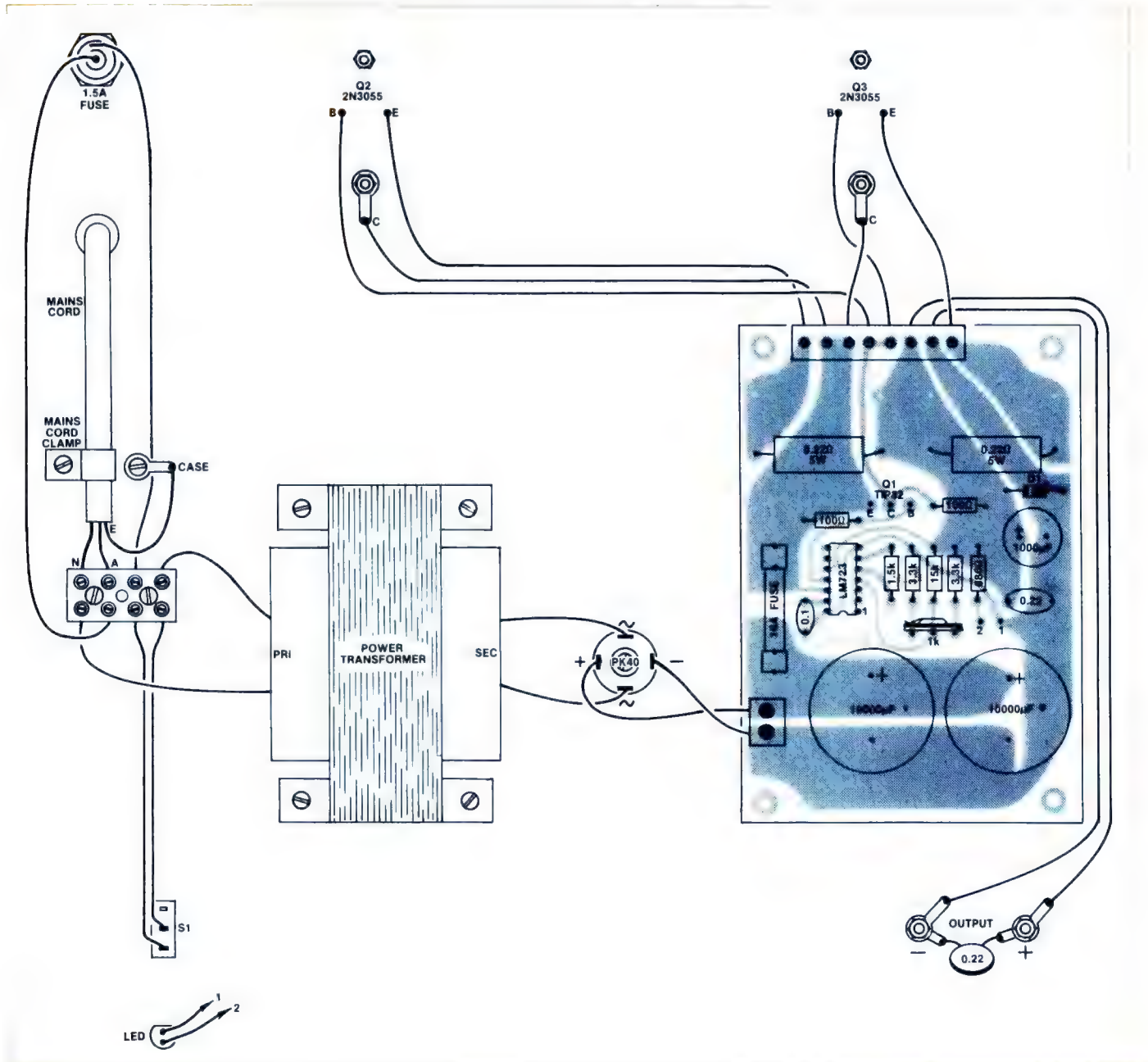
$90

This includes sales tax.

How it works

Fig. 1 shows the complete circuit diagram of the VK Powermate while Fig. 2 shows the schematic of the 723

Below: parts overlay and wiring diagram. Use 4mm auto cable for the high-current wiring.



regulator. The latter figure shows the 723 regulator as comprising a series pass transistor, error amplifier and reference voltage source. The error amplifier compares a proportion of the output voltage with the internal reference voltage source and makes continual adjustment to the base current of the series pass transistor.

Low dropout voltage

Maximum current rating of the series pass transistor in the 723 regulator is 150mA. This must be amplified by external power transistors to provide a supply capable of several amps. In this circuit the series pass transistor is used to drive a PNP power transistor (TIP32) which in turn provides current drive to two NPN power transistors (2N3055).

This arrangement has a low dropout of about 3V, which is equal to that of the 723 when used alone. Consequently, this circuit has very good line regulation without having excessive power dissipation.

The TIP32 transistor has a 100Ω resistor connected between its base and emitter, and the two 2N3055s have similar resistors connected between their base and emitter circuits, though not directly to their emitters, which are isolated by the 0.22Ω resistors. These 100Ω resistors avoid the possibility of high temperature leakage degrading the regulation characteristic of the power supply.

A problem which can arise through using parallel output transistors – as we have done – is unequal load sharing. Due to slightly differing characteristics, one transistor may tend to conduct more heavily than the other. This is prevented by the inclusion of current sharing resistors in the emitter circuit of each transistor, which forces the transistors to accept an equal share of the load.

Alternative resistors

The value of these resistors is given as 0.22Ω, but we realise there may be some difficulty in obtaining these in the 5W range. For this reason we have designed a printed circuit board which will accept two parallel 5W resistors in each position. This would allow 0.47Ω resistors to be used and these are in plentiful supply.

A 1.5kΩ resistor is connected between pins 5 and 6 of the 723. This is included to make the source impedance feeding the non-inverting input of the error amplifier approximately equal to the source impedance of the output voltage divider which drives the inverting input. Adding this single component makes quite a worthwhile improvement to the temperature stability of the output voltage.

The output of the regulator is heavily bypassed to give a low output impedance at radio frequencies and to ensure good transient response.

A crude but effective method of over-voltage protection is used in this circuit. It consists of a zener diode, of appropriate voltage rating, and 5W or higher power rating, wired directly across the output terminals. If, for any reason, the regulator circuit malfunctions and the output voltage tends to rise above the selected voltage, the zener will draw very heavy current and blow the 10 amp fuse.

The zener voltage selected will depend on the tolerance of the transceiver or other equipment to excessive voltage. Most service manuals specify an absolute maximum voltage, typically 15 for a nominal 13.8V unit. Thus a 15V zener would be appropriate.

In blowing the fuse the zener itself will most probably be sacrificed, but this is a small price to pay in order to protect a valuable piece of equipment. There are more elegant methods of protecting transceivers against over-voltage, but this method is simple and reliable.

Construction

Most of the circuit components are mounted on the printed circuit board (PCB) which is coded 83ps12 and measures 82 x 119mm. Dominating the PCB are the two 10,000μF/40V electrolytics (Elna) which have a combined ripple rating of 10.4A at 120Hz. Substitution of smaller electrolytics is not really recommended as their lower ripple ratings may lead to reduced service life.

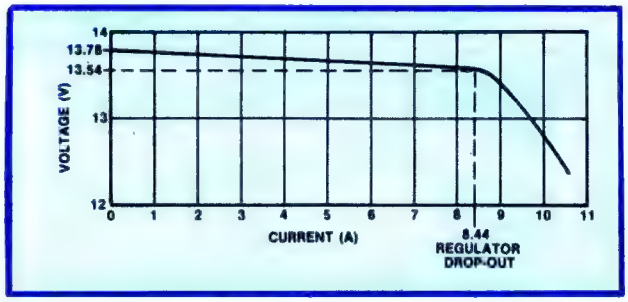
Do not substitute a less rugged transistor for the TIP32, which has a collector current rating of 4 amps. Other transistors (such as 2N3053 or BD140) will work, but on overloads they will "punch through" before the 10 amp fuse blows. And if that happens, the 723 IC will blow too.

A small flag heatsink should be fitted to the TIP32. This can be either a commercial unit or a piece of light gauge aluminium about 20 x 30mm.

Do not try to increase the output rating of the Powermate by increasing the fuse rating. This will only lead to the possibility of damage to the 3055s, and quite possibly to other parts of the

Left: actual size PCB artwork. Ready etched boards are available from kit retailers.

Below: this graph plots the line output as a function of load. Regulation is maintained for loads up to 8.44A.



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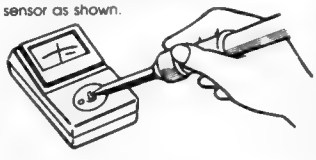

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PI-6458	18 WAY SOCKET	$1.45	$1.35
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PI-6464	24 WAY SOCKET	$1.95	$1.80
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HE-1462	93/8V 228(D) x 76(H) x 203(W)	$18.00
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circuit. The specified 10A fuse will take surges of up to 14A before it blows, which is well above the regulator drop out current.

At 305 x 205 x 90mm, the K&W case can easily accommodate all the components and allows some free space for cooling. Between the transistors, bridge rectifier, transformer and power resistors, there is a lot of heat generated when the supply is working hard. In addition to the slotted lid, we would recommend drilling a series of holes across the bottom of the chassis to promote air flow.

If the planned use of the power supply suggests that additional heatsinks should be fitted, there are a number of types available. Two small heatsinks will probably be a more convenient arrangement than one large one and two types listed in the Dick Smith catalog would seem to be suitable. One is listed as H-3422 and the other, slightly larger, as H-3460. They should be mounted with the fins vertical.

The transformer used is known as the "M2000" and has a rating of 18VAC at 6A (ours was supplied by Jaycar, but other kit sellers have an equivalent). Virtually any transformer with a secondary voltage of 17 to 18V at a current of 6A is suitable. Lower current ratings could be used if the inferior load regulation is acceptable.

In the other direction there is at least one transformer available with an 8A rating. This is the model JT 266, made by Jones Transformers Pty Ltd, and available from Ace Radio, 136 Victoria Rd, Marrickville, NSW.

When mounting the output transistors, use a mica washer, two insulating bushes and heatsink compound. Most of these are available in TO-3 mounting kits. The connection to the collectors of these transistors is made by means of solder lugs to one of the mounting screws for each transistor (the case is the collector for this type of transistor). Later, when the Powermate has been tested, plastic covers should be fitted to the 3055s.

An EDI Minibridge, type PK40F, is used as the bridge rectifier. It has an average current rating of 8 amps. As with the transistors, the PK40 heatsinks to the chassis, but no mica washer need be used here – the metal face of the rectifier is not an electrical connection. Alternatively, the bridge rectifier could be the higher rated PB40 which is widely available.

A pair of binding post/jack sockets are used for the ouptut connections. Don't forget to use heavy duty insulated wire for all the high current wiring. The type known as "4mm auto cable" is suitable.

The 0.22μF ceramic capacitor is connected across the back of the output terminals. This provides RF bypassing of the output. The negative output terminal may also be connected to the case to minimise the effects of radiated RF signals. This could be a consideration when the antenna of high power equipment is very close to the power supply, although we were not able to induce any anomalies with the antenna of a 2-metre set only a metre away.

Take care with the mains wiring. The three-core mains cord should be passed through a grommetted hole in the rear of the case and anchored with a cord clamp. Mechanically terminate and solder the earth wire to a solder lug secured under one of the transformer mounting screws. The rest of the circuit is not earthed.

Terminate the active and neutral conductors plus the wires to the transformer primary and the mains switch to a three-way insulated terminal block. Make sure that the soldered connections to the mains switch and transformer primary fuse are insulated with heatshrink tubing or "spaghetti".

When construction is complete, check all wiring carefully. To protect the over-voltage zener diode, it is important that the 1kΩ trimpot be set initially for minimum output voltage. This is with the wiper closest to the positive rail or, in physical terms, fully anticlockwise as seen from the rear of the case.

Test the supply with a dummy load before it is used with a transceiver. A piece of jug element cut to a length would be suitable. Make sure that the output voltage does not change by more than 200mV between the loaded and unloaded conditions. This is a far more valid test than operating the power supply with a transceiver because your voltmeter is quite likely to be upset by the transmitted signal.

In this regard, analog meters are likely to be less affected than their digital counterparts. We found a digital meter to have an error of 1V during transmit, a cheap analog to have an error of 0.5V and an expensive analog to have no error. To test whether an indicated change in voltage is genuine, short the test leads of the meter together and transmit. Obviously, any reading on the meter is an induced error – but don't be surprised if this does happen.

(Note that the suggested dummy load will get very hot, and may even burn out, if used for more than a few seconds at a time. This should be long enough to set the voltage but, if prolonged testing is necessary, it would be necessary to immerse it in water.)

During normal operation, the output transistors will become quite hot, especially if the supply is running at 6A continuously. This is quite normal. All components are within ratings.

So there it is; a rugged power supply with excellent filtering and regulation which should be large enough for all but the very large transceivers. It would also serve as a bench supply for any service organisation handling car radios and similar equipment. It should have a long and useful life.

PARTS LIST

1 K&W case, 306 x 204 x 90mm or similar metal project case.
1 Scotchcal front panel, 305 x 90mm
1 PCB, 82 x 119mm, code 83ps12
1 transformer with secondary 17 to 18V at 6A
1 SPST mains toggle switch
1 4-way insulated mains terminal block
1 2-way PC-mounting terminal block
1 8-way PC-mounting terminal block
2 heavy-duty binding posts, 1 red, 1 black
1 3AG panel mounting bayonet fuse holder and 1.5A fuse
2 fuse clips, Swann FC1
1 3AG 10A fuse
2 solder lugs
1 flag heatsink (for TIP32)

SEMICONDUCTORS
1 LM723 or μA723 IC regulator
1 TIP32 PNP transistor
2 2N3055 NPN transistors
1 PK40 or equivalent bridge rectifier
1 15V 5W zener diode
1 LED and bezel

CAPACITORS
2 10,000μF/40V electrolytic (PCB mounting)
1 1000μF/16V electrolytic (PCB mounting)
1 0.22μF ceramic
1 0.22μF metallised polyester (greencap)
1 0.1μF greencap

RESISTORS (¼W, 5%)
1 x 15kΩ, 2 x 3.3kΩ, 1 x 1.5kΩ, 1 x 680Ω, 2 x 100Ω, 2 x 0.22Ω/5W (see text), 1 x 1kΩ trimpot (large vertical)

MISCELLANEOUS
4 rubber feet, 4 nylon PCB stand offs, 1 grommet, mounting hardware for TO-3 transistor, heatsink compound, 2 TO-3 plastic covers, mains cord and three-pin plug, mains cord clamp, heatshrink tubing, 4mm auto cable, hook-up wire, screws, nuts, lockwashers, solder.

NOTE: Component substitutions are not recommended. See text.


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ROM	16K	16K	12K	10K	20K
Microsoft BASIC	Yes	No	Yes	No	No
Colours	27	No	15	16	16
Screen display	40 x 24 or 80 x 24	64 x 16 or 80 x 24	40 x 24	40 x 24	40 x 24
Resolution	640 x 288	512 x 256	280 x 160	320 x 192	320 x 200
RF, Video and RGB	Yes	No	No	No	No
Runs CP/M 2.2	Yes	No	No	No	No
RS232C	Yes	Yes	No	No	No
Centronics/Parallel Port	Yes	No	No	No	No
Power supply built in	Yes	No	Yes	No	No

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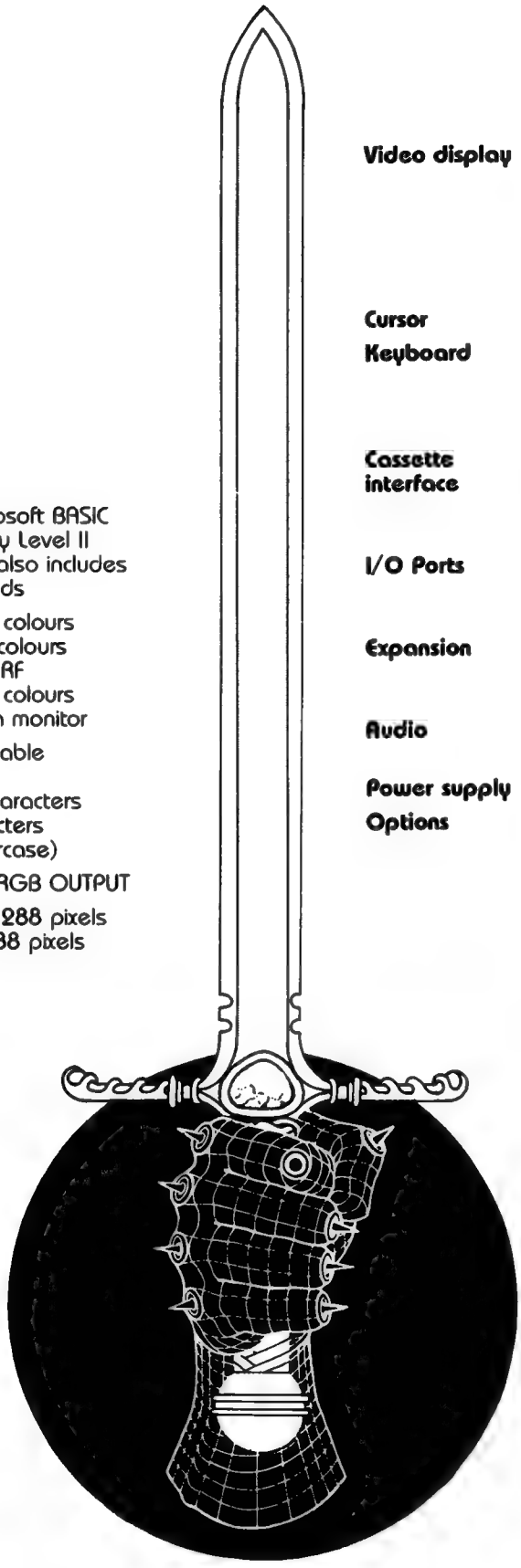
Screen Mem	2K
Colour Mem	2K
PCG Mem	2K
User RAM under Disk drives	64K
Actual user RAM under BASIC	48K
Language	Extended Microsoft BASIC Similar to Tandy Level II Disc Basic but also includes colour commands
Colour	16 foreground colours 8 background colours using video or RF 27 foreground colours using RGB with monitor
Graphics mode	128 programmable characters 128 graphic characters 96 ASCII characters (includes lowercase)
Video	RF, video and RGB OUTPUT
Resolution	Low res 320 x 288 pixels Hi res 640 x 288 pixels
Video display	24 lines x 40 characters 7 x 12 dot matrix (TV or monitor) 24 lines x 80 characters 7 x 12 dot matrix (monitor preferred)
Cursor	Flashing block
Keyboard	Full size 60 key QWERTY layout 4 programmable function keys – 8 functions
Cassette interface	Built in software controlled at 1200 and 300 baud – Kansas City (counter timer circuit)
I/O Ports	Serial. full RS 232C Parallel. 8 bit centronics compatable
Expansion	2 expansion ports on board each providing all major control and data lines
Audio	Single channel 3 octaves programmable under BASIC
Power supply	On board
Options	Disc controller board Direct connect Modem



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The Serviceman

A tricky intermittent & more on TV fires

My main story this month concerns a simple case of frame collapse; simple, that is, in the sense that it is a common fault and usually not hard to trace. But it seems that there is always room for variation on a theme. And, in this case, it led me quite a dance.

The set involved was a Philips K9, and one which I had serviced a number of times over the years, mainly for routine faults. On this occasion the customer rang to say that the set had developed a bright line across the centre of the screen; the typical symptom and description for a frame collapse condition.

I duly called at the house, switched the set on, and observed the effect exactly as the owner had described it. Nor did it take much effort to find the immediate cause of problem. Swinging out the larger of the two boards, carrying the scan circuits, my attention was immediately drawn to two 5W resistors, fitted with thermal cutouts, near the top left hand corner of the board.

One, R483, 22Ω, supplies the +20V rail for the vertical deflection circuit, and the other, R487, 33Ω, supplies the −20V rail. These are spring loaded devices, held closed with solder, which spring open if the resistor overheats and melts the solder. It is not unusual to find that one of these has tripped in the case of frame collapse, either because they have sensed a fault elsewhere in the circuit, or because they sometimes develop a fault themselves.

And so it was in this case; R483 had tripped, though for what reason was not immediately obvious. All I could do was reset it and see what happened. However, I did take the precaution of using 50-50 type solder in place of the usual 60-40 type. This is in line with a recommendation issued by the makers, following a tendency on the part of the original units to open unnecessarily in hot weather, or because repeated heating and cooling apparently caused a form of metal fatigue in the solder.

Then I switched on and waited. The picture came up normally, there was no sign of distress, and the set continued to play for the next 10 minutes or so while I gave it a routine once over and touched up height, linearity, etc. Finally, I concluded that it had most likely been a simple solder failure and that nothing more was needed. However, I warned the customer to call me immediately in the event of trouble.

I heard nothing for the next couple of weeks, and I had assumed that my diagnosis was correct. Then the customer was on the phone, with the news that the set was playing up again. When I enquired as to whether it was the same fault the owner said no, it wasn't exactly the same. As he described it, the set would run for long periods and then would develop a series of horizontal streaks, followed by frame collapse, but with a white line at the top of the screen rather than in the centre.

Then he added that, by switching the set off for a few minutes and switching it on again, it would perform perfectly, usually for several hours. These symptoms didn't fit any pattern I had encountered before and, because of the intermittent aspect, I decided that the set would have to come into the workshop. I advised the customer accordingly, and arranged to pick the set up in a couple of days when I had another call in the same area.

In fact, by the time I did call for the set it had reverted to the original fault; a bright line in the centre of the screen which no amount of on-off switching would cure. This wasn't surprising, since R483 had flipped again.

Back at the workshop I cleared a corner of the bench for the set, swung out the board where I could get at it quickly, reset R483, and switched on. As I expected, the set came up normally, with no signs of distress, and kept on running for the rest of the day.

But what I didn't expect was that the

set would keep on like that, day after day, for over a week. According to the owner it would seldom run for more than a day without giving trouble, and never more than two days. So why wouldn't it play up on my bench.

At this stage I suddenly had a horrible thought. Had I unwittingly deceived myself with the bench set-up? I swung the board back inside the cabinet, re-fitted the back, switched on and waited. All went well for an hour or so, then I happened to glance at the screen and, lo and behold, there were the streaks across the screen just as the customer had described them.

A few minutes later the picture collapsed, leaving a bright line across the screen about 25mm from the top, again just as the customer had described it. There was no doubt in my mind now; the fault — whatever it was — was markedly temperature sensitive. And, by leaving the cabinet open, and the board swung out for easy access, I had completely nullified the test.

What was more, the weather had been quite cool over the previous week, whereas now, after I had closed the cabinet, it had turned much warmer. Mentally kicking myself for being deceived so easily, I tried to work out what was the best way to tackle the fault from here.

THE OLD BLANKET TRICK

Quite obviously, the cabinet had to be opened and the board swung out for me to work on it, so I resorted to the old blanket trick, draping it over the board and the open back of cabinet. I switched on again and the set, which had cooled by now, came up normally. I sat and waited.

Sure enough, after about 15 minutes, the frame collapsed as before. I lifted the blanket clear and turned around to reach for a can of freezer on the bench, intending to spray the most likely components and, hopefully, pick out the faulty one. But as I turned back to the set I realised it wasn't going to be that easy; in the few seconds that the blanket had been off the set had come good.

I tried this blanket-on, blanket-off routine a couple more times and confirmed that the whole set-up was extremely critical but, also, that I could create either condition virtually at will. At this stage I brought the CRO into action. The main deflection circuit, which is direct coupled, consists of some eight transistors, TS540, 545, 550, 560, 565, 568, 570 and 580, more or less in that order from input to output.

I connected the CRO to the input of the first stage, TS540, and, by juggling the blanket, confirmed that the waveforms at this point did not change with the fault condition. That ruled out the circuitry ahead of this point and made the remainder of the chain the prime suspect.

At this point I had intended to follow through with the CRO to pinpoint the faulty stage, but I found that trying to work with the blanket draped over the set extremely awkward. Instead, I rigged up a small radiator to direct heat onto one side of the board.

And that was where I allowed myself to be sidetracked. I started by heating the component side of the board, but found that it seemed to take inordinately long for the heat to work, even though the components were quite hot. So I tried heating the other side, whereupon the set reacted in only a fraction of the time. This convinced me that I probably had a pattern fault; a hairline crack or something similar.

I went over that side of the board with a fine tooth comb. I examined it under a glass, I bridged likely tracks, I prodded and probed; all to no avail. Finally, I was forced to the conclusion that, in spite of my observations with the radiator, there was nothing wrong with the pattern and that it had to be component fault.

Leaving the radiator directed on the pattern side I was about to start probing with the CRO again when, on impulse, I picked up the can of freezer and squirted several transistors. This restored performance, but it was hard to tell which transistor was responsible, if any, because other components, and the board, also copped some of the freezer.

But I did narrow the area down to that around TS540, 545, and 560, where the briefest burst was enough to cure the fault. And of these three, I fancied that TS545 seemed to be marginally the more sensitive. It was quite easy to change this, which I did, but drew a blank; the fault was as much in evidence as before.

Next I changed TS540 and that was it. No amount of heating and cooling would produce the fault. But was the transistor faulty, or had I cured a subtle dry joint in replacing it? Remembering the sensitivity of the pattern side of the board to heat, I still had my doubts.

Determined to settle the matter once and for all, I put the old transistor back in the board, whereupon the fault returned, exactly as it had been before. So that proved that point, but why did the fault respond more readily to heat on the pattern side of the board?

I even tried heating the body of the transistor directly, with the soldering iron, and even this required a considerable time to create the fault, compared with heating the pattern side of the board.

I finally concluded that the transistor fault probably involved one of the leads, such as a faulty joint to the lead, and that

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heat applied to the lead, via the copper pattern, raised the temperature at the fault site much more rapidly than heat applied to the body, where it would encounter much more thermal resistance.

Which is a nice neat explanation in hindsight, but the situation completely confused me on the workbench, and sent me off on a time wasting wild goose chase. The lesson to be learned, I think, is not to switch horses in mid-stream. Or, in other words, when you start out on a test sequence, follow it through.

MORE ON TV FIRES

To change the subject, here is another story about the possible cause of fires in TV sets. I dealt with this at some length in the October notes, featuring a story from Mr J. L. of Tasmania, with photographs of a particular switch found in a Blaupunkt receiver which was all set to burst into flames. Following that I received a letter from another serviceman, Mr J. M. of Warwick, Queensland, describing a completely different potential fire cause. He writes:

The job commenced in the usual fashion; a phone call. The customer told me his TV set had caught fire, and could he bring it into the workshop for repairs. The statement "My TV set has caught fire" is usually an exaggeration. In most cases the customer has seen a thin wisp of smoke from the back of the set, or has smelt a burning odour, as when a fusible resistor burns up.

In this case, however, I was told that the flames were put out with a small extinguisher. I asked him where the flames had appeared, and he told me the plastic front of the set, just under the controls. I arranged for him to bring the set into the workshop the next morning. Meanwhile I puzzled over what could have happened. I have been in the TV service industry for 16 years and the number of fires I have encountered in TV sets would come to less than a handful.

Next morning the set arrived and was placed on the workbench. It was a 63cm Philips, with a K11 chassis. Looking at the front escutcheon of the set, a 5cm x 2cm melted hole was clearly visible. The odd thing was its location; right in front of speaker.

Closer investigation showed that there was no speaker cone to be seen and, on removing the speaker frame, the only thing remaining was the burnt wiring of the voice coil winding. Quite obviously the speaker had caught fire — but why?

My first thought was that perhaps a spark had dropped from the power switch and had ignited the speaker cone, but closer investigation showed that the location of the power switch made this impossible. A high DC voltage across the voice coil winding would certainly cause it to overheat, even get red hot before going open circuit. Could this be the cause?

A check of the circuit diagram revealed that transformer coupling was used between speaker and output transistors, which made this possibility remote. A check was made of the wiring and everything was found to be as per the circuit diagram.

A new speaker was installed and the set tested. Sound came on normally and no irregular DC voltages were found. The only conclusion I could reach was that the voice coil had developed a shorted turn which had caused a high current to be drawn through the remaining turns. This would have caused them to ignite the paper voice coil former and, in turn, the cone.

Careful questioning of the customer revealed no new clues. Apparently the family had been watching the program with the sound at its normal level, and no distortion was heard before smoke and flame appeared at the front panel. The only other damage arising from the incident was a slight distortion of the plastic channel selector switch bank, which was replaced.

This most unusual fault raises the following questions: has a house fire been caused by a speaker which has ignited? And are speakers the safe devices we thought they were?

After completion of this job I recalled an incident which took place a few years earlier. I had sold an inexpensive pair of car speakers to a young chap, who installed them on the back parcel shelf of his car. A couple of weeks later he complained he saw smoke coming from one of the speakers, followed by distortion in that speaker.

I replaced the speaker under warranty, and then carried out a post mortem on the faulty speaker. When audio was applied the sound was heavily distorted and an ohmmeter across the winding showed a lower than normal reading. On removal of the cone and voice coil assembly I observed that the central windings had turned black with heat and that the coil was burnt nearly in half.

I wonder if others have had similar experiences.

Thank you J. M. Your experiences certainly do raise some pertinent questions; particularly the ones you pose yourself. Until the exact reason for such incidents can be determined, it is unlikely that the questions can be answered, or suitable precautions taken.

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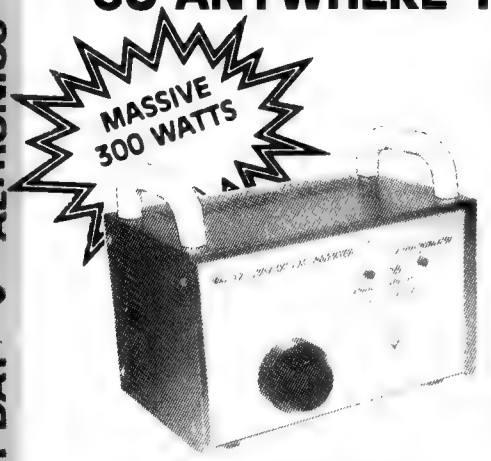

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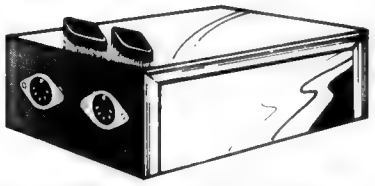

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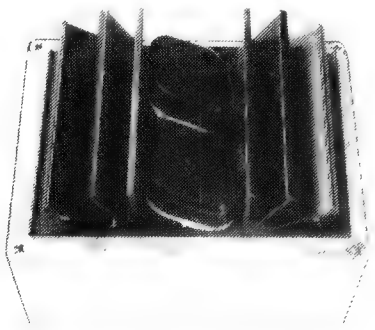

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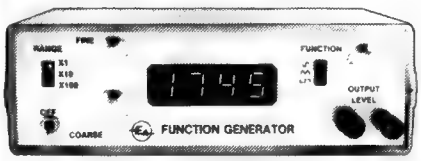

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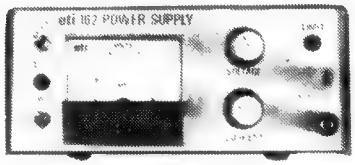

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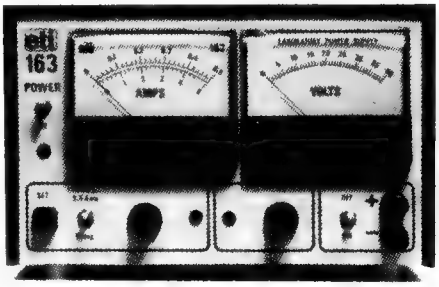

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Design Techniques for

In Part 1 of this article we discussed basic rhythm structures and established the principles of rhythm generation using clock oscillators, counters and instrument simulators. From this theoretical discussion we now move on to practical circuits which can exploit these ideas and serve as a basis for further experimentation.

As we established in part 1, the basis for every rhythm unit is a device that generates pulses sequentially on separate output lines. One can obtain rhythm effects with as few as three or four output lines but to allow for more interesting variations 16 lines must be considered the minimum and for very fancy rhythm patterns one may need 32 lines to allow for 1/32 beats. Rather than just give one circuit, we shall discuss several approaches; a basic 16 line version, a 32 line version, and a scanning multi-pass circuit. We shall also give some diode matrix rhythm pattern examples.

One word of warning. If you decide to start experimenting with pulse

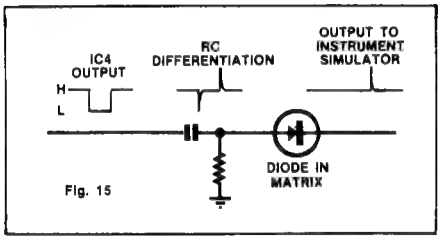


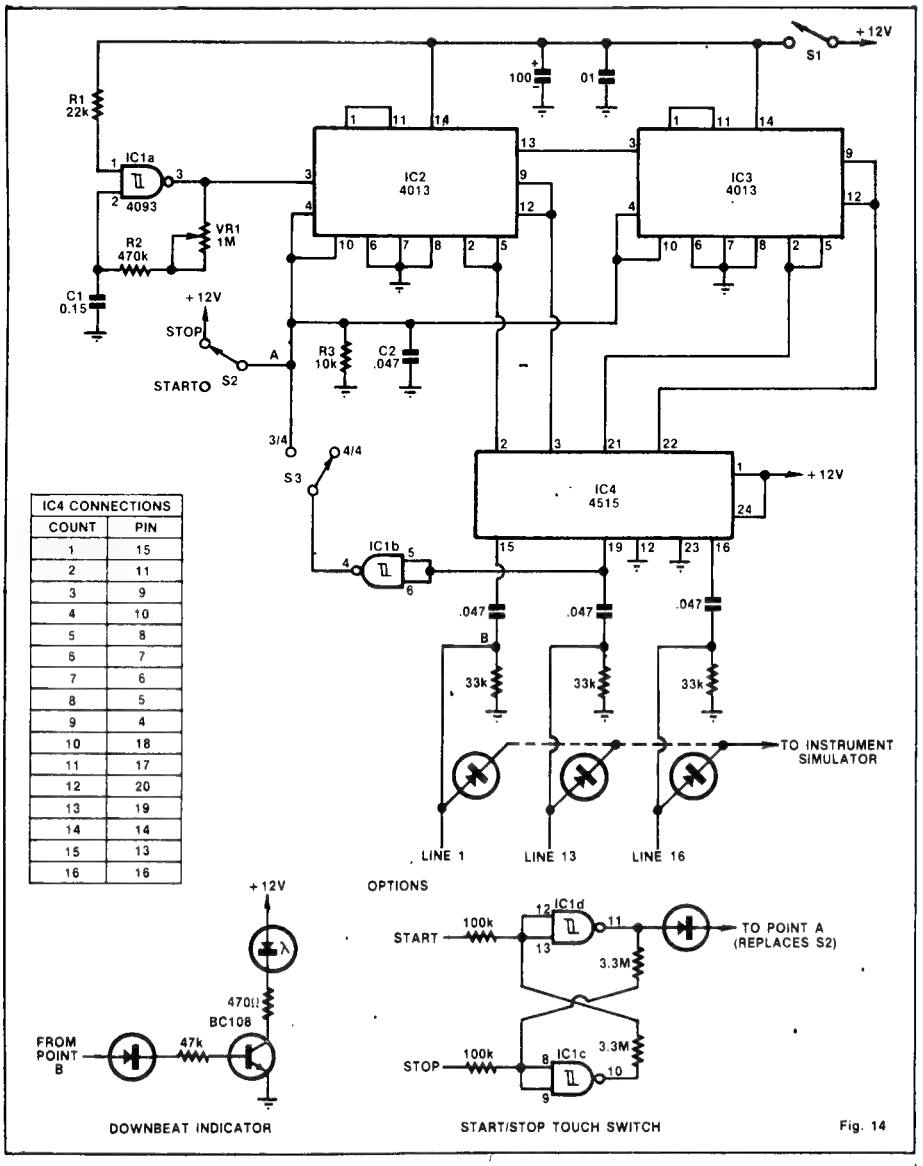
Fig. 15

generating circuits, make sure you have an oscilloscope. Without this instrument it is almost impossible to track down faults in the circuit if it does not work.

The complete circuit of a basic single pass 16 beat pulse counter is shown in Fig. 14. The heart of the circuit is the combination of IC2, 3 and 4 which together form a counter with one clock frequency input and 16 output lines. IC2 and 3 are dual D-type flipflops (4013) which together form four flipflop stages in cascade. The Q output of each stage is used to provide the four input lines to IC4.

Depending on the state of each flipflop, the four lines carry a code of high and low voltages. These codes are accepted by IC4, a 4-to-16-line decoder, type 4515. Each input code results in one of the 16 output lines being activated. We shall therefore require a sequentially changing code to obtain the required effect of the 16 output lines to be activated in sequence.

The outputs of IC4 are normally high and will go low one by one when the ap-



IC4 CONNECTIONS	
COUNT	PIN
1	15
2	11
3	9
4	10
5	8
6	7
7	6
8	5
9	4
10	18
11	17
12	20
13	19
14	14
15	13
16	16

Fig. 14

TABLE 1

Input pulse number	Output IC 2 and 3 stage 1	stage 2	stage 3	stage 4	IC4 pin low
1	L	L	L	L	11
2	H	L	L	L	9
3	L	H	L	L	10
4	H	H	L	L	8
5	L	L	H	L	7
6	H	L	H	L	6
7	L	H	H	L	5
8	H	H	H	L	4
9	L	L	L	H	18
10	H	L	L	H	17
11	L	H	L	H	20
12	H	H	L	H	19
13	L	L	H	H	14
14	H	L	H	H	13
15	L	H	H	H	16
16	H	H	H	H	15

Rhythm Generators *Part 2*

by **NICK LABORDUS** *5/3 Durham Close, North Ryde NSW 2113*

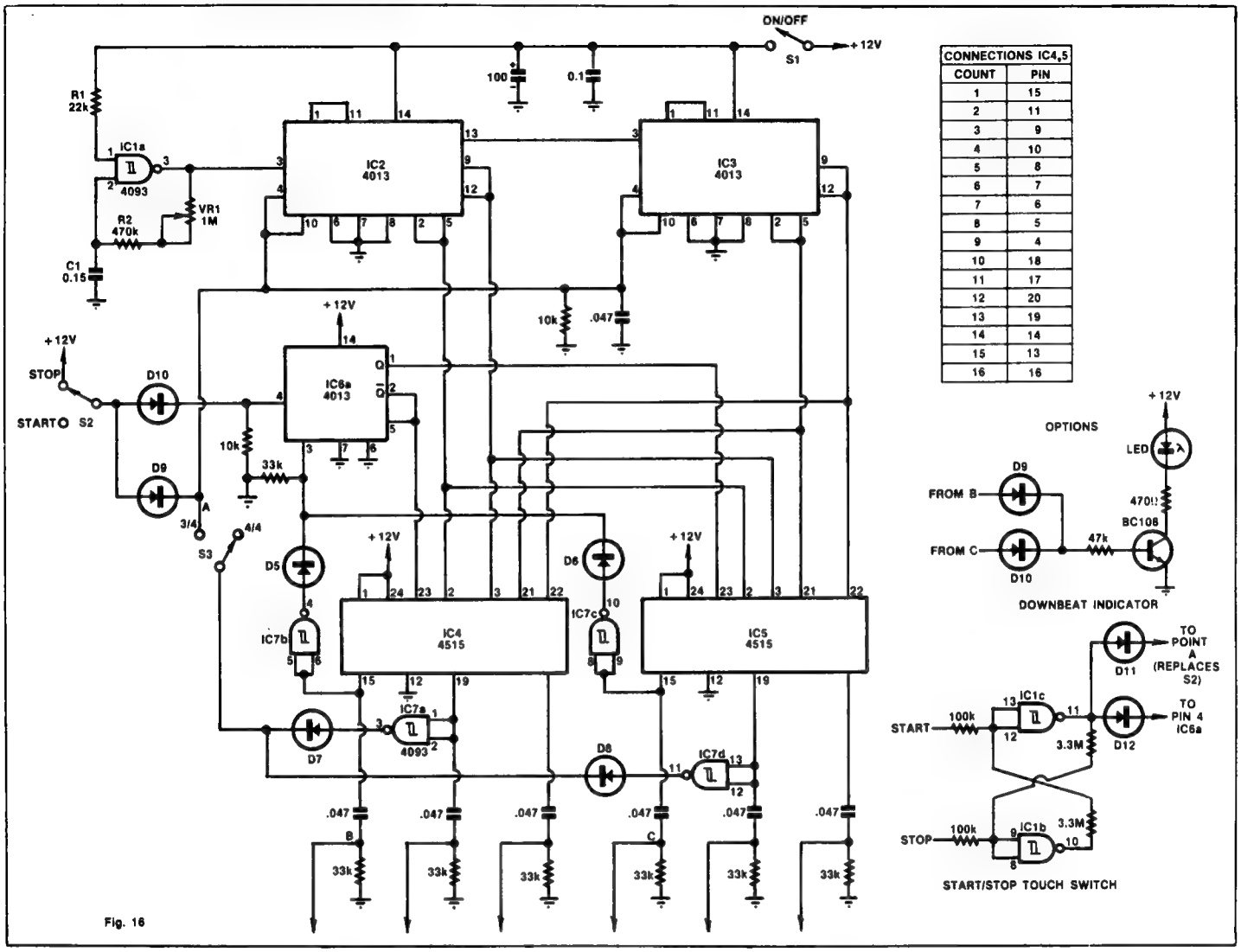


Fig. 16

propriate input code is presented. As we shall see later, the instrument simulators require a sharp pulse at their input. This means that the output signals of IC4 must be differentiated (Fig. 15). Differentiation of a square wave by an R/C network results in two pulses, a negative one on the falling edge of the square wave and a positive one on the rising edge. Only one of these two can be used to activate the instrument simulator and a decision must be taken before the counter circuit can be designed.

Either version is possible but as there is a time shift between the positive and the negative pulse, the choice has some effect on certain reset connections in the counter circuit. In our example we have selected instrument simulators with a positive input pulse.

In Fig. 14, IC1a and its associated components form the clock pulse generator, the frequency of which is determined by the values of C1, R2 and VR1. The clock produces square wave pulses which are fed into four flipflop circuits in cascade. Both IC2 and IC3 consist of two flipflops each. Each flipflop stage divides its input pulse frequency by two. At a clock frequency f, the respective output frequencies of the stages 1 to 4 are: Stage 1 (pins 2, 5 IC2) f/2; stage 2 (pins 9, 12 IC2) f/4; stage 3 (pins 2,5 IC3) f/8; stage 4 (pins 9, 12 IC3) f/16.

Table 1 shows the behaviour of the four output lines as new pulses from the clock generator arrive at the input of flipflop 1. Table 1 also shows which of the 16 output lines of IC4 (indicated by pin number) goes from high to low at what input code. Note that the flipflops return automatically to the first code after having reached the 16th. This suits our aim perfectly for all non-waltz rhythm patterns. For waltz pattern we need only 12 lines and we shall have to reset the counter after it has produced the 12th output pulse.

But before considering this function in detail we will have to modify the beat (input pulse) numbers of Table 1. This is due to the need to always start the rhythm generator on beat 1.

Using the "on-off" switch to start the unit will result in the counter starting in a random fashion rather than on beat 1 (the down beat). This can be overcome by introducing a separate switch for the "start-stop" action, leaving the "on-off" switch in the "on" position so that all cir-

Design Techniques for Rhythm Generators

cuits are functional.

In the "stop" position, S2 connects a high to reset pins 4 and 10 of IC2 and 3. This forces the four selected outputs to show HHHH, independent of the arriving clock pulses. As soon as the switch is moved to the "start" position, the clock pulses will start to take effect again and the first one arriving will send all four outputs to low (LLLL). In doing so, pin 15, which was low due to the HHHH input, returns to its normal high position.

This return to high will result in an active output pulse on pin 15, and means that the actual "down beat" does not occur on pin 11 (pulse 1, or line 1), as in Table 1, but on pin 15 (pulse 16, or line 16). This does not present any problem as long as we re-number all other beats (or lines) by adding 1 to the beat numbers in Table 1.

Now we can discuss resetting after beat 12 for the waltz. In Fig. 14, output pin 19 of IC4 is connected, via inverter IC1b and the 3/4 (waltz) switch, to the reset inputs pins 4 and 10 of IC2 and 3. Pin 19 corresponds, after "re-numbering", with beat 13. The very moment this output goes low, the falling edge results in a rising edge at the output of IC1b which in turn resets IC2 and 3. The latter now present HHHH to IC4, resulting in pin 15 (the down beat) being activated.

Pin 19 will go low for a very short while to initiate the reset. As soon as the reset has occurred, pin 19 returns to high. This results in an unwanted output pulse but this pulse is so short that its energy is insufficient to trigger the instrument simulator.

Each output line of IC4 is connected to the diode matrix by a differentiating circuit consisting of one .047μF capacitor and one 33kΩ resistor. The diodes in the matrix must have the anode side connected to the output lines so that only the positive pulses will arrive at the instrument simulators.

Having two spare gates in IC1, we can add a touch control to our rhythm unit without much effort. Touching one of the inputs with the finger will produce a high output, acting as "stop" by resetting IC2 and 3. A touch on the other input will cause the output to go low, thus starting the counter. This facility is perferred over the switch version by many musicians as it allows them to activate the rhythm unit quickly during playing. The inputs can be connected via screened cable to two small conducting plates next to the keyboard.

A further option indicated in Fig. 14 is the downbeat indicator. This circuit causes a LED to light at each downbeat (pin 15 after "re-numbering").

This circuit, and the one to follow, will work satisfactorily over a fairly wide range of supply voltages, up to 15V. The 100μF and 0.1μF capacitors on the supply rail ensure a low impedance path for the pulses.

The next step from the 16-line counter is a 32-line counter. This circuit can create fancy rhythm patterns with 1/32 beats or act as a double-pass 16-beat counter, allowing some reduction of monotony. The full circuit is shown in Fig. 16. The heart of the circuit is the same as that of the 16 beat counter. In this case there are two 4-to-16-line decoders to obtain 32 output lines. The only other addition is a flipflop (IC6a) which, at the correct moment, switches from IC4 to IC5 and back.

The input codes from IC2 and 3 are presented in parallel to both IC4 and 5. Pin 23 of these decoders enables the input codes to be accepted or rejected. If pin 23 is high, the decoder is blocked and all 16 outputs are high. If pin 23 is low, the decoder reacts to the input code in normal fashion. In each case, pin 23 is connected to an output (Q or $\overline{Q}$) of flipflop IC6, the state of which is switched each time the active decoder reaches the downbeat.

Assume IC6 output 2, 5 is low. This allows IC4 to operate. After it has gone through its 16 output lines it returns to line 1 (pin 15). The falling edge of this output pulse (going low), activates the flipflop IC6 via inverter IC7b. IC6 now changes state, blocking IC4 and enabling

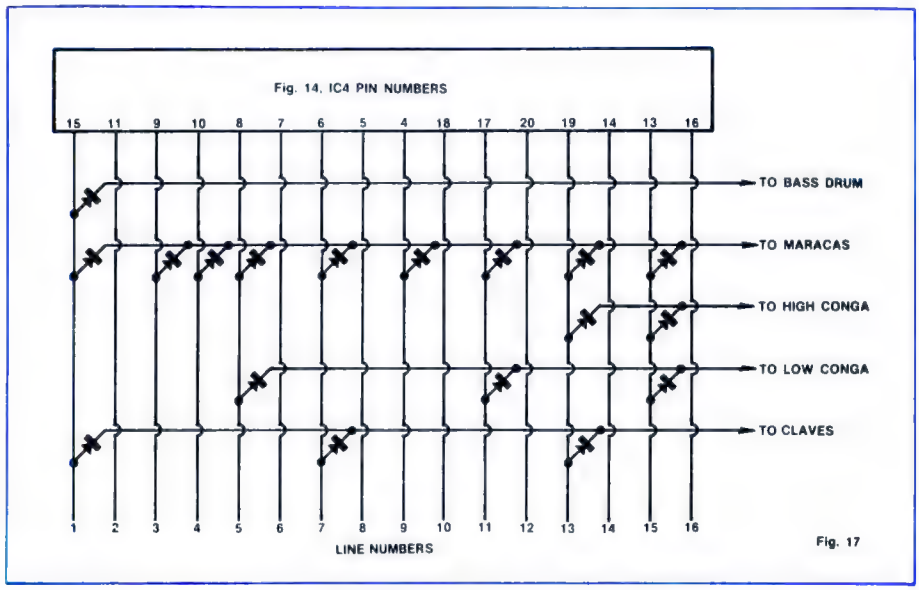


Fig. 17

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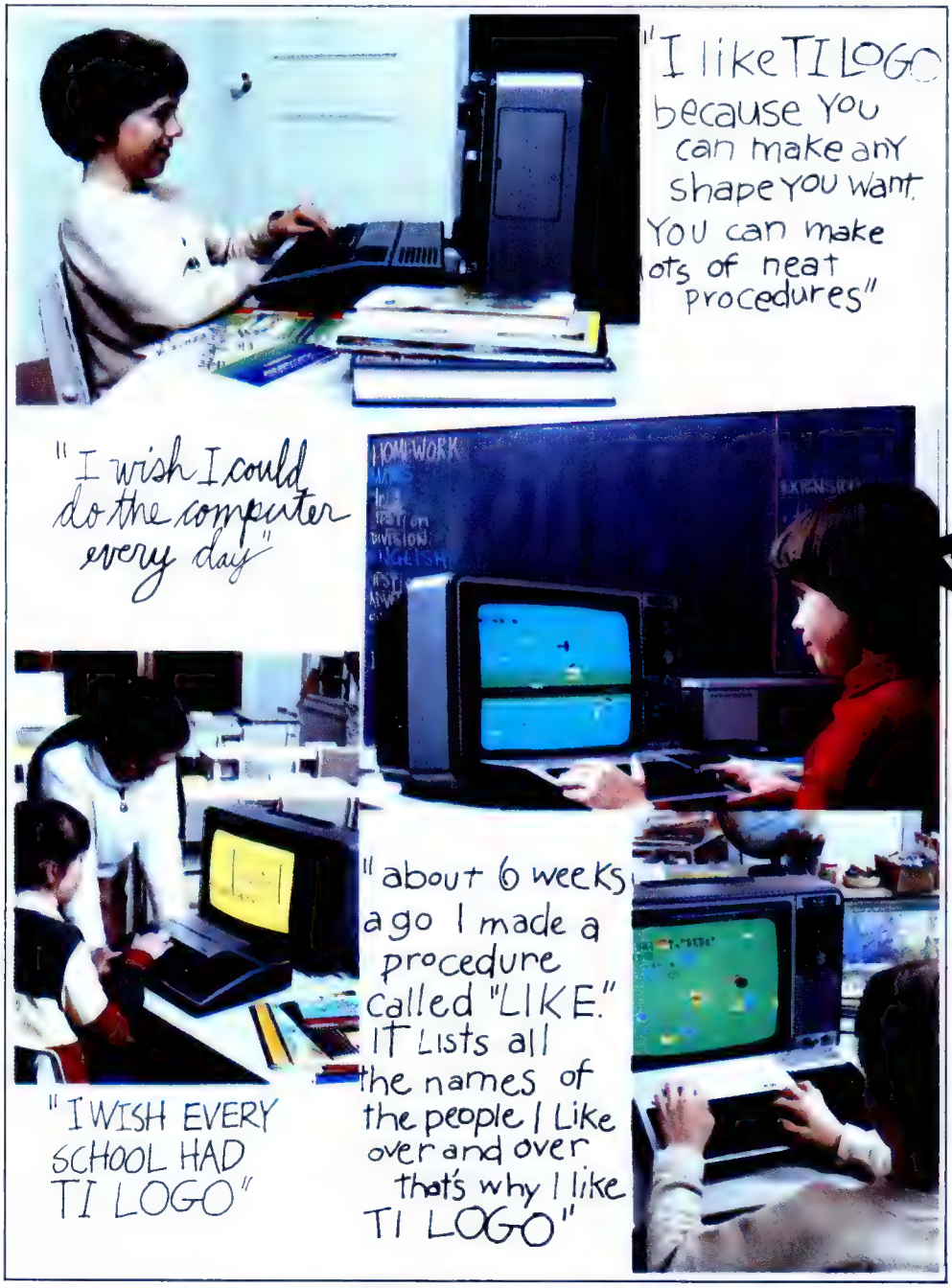

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Design Techniques for Rhythm Generators

IC5. The latter now reacts to the available HHHH input by sending pin 15 low, this pulse becoming the down beat for the IC5 cycle of line pulses.

(Note that there is an active output pulse on pin 15 of IC4 at this moment, as this pin returns to high. This pulse is so short, however, that the energy content is insufficient to activate the instrument simulator.)

This low pulse on pin 15, IC5, also appears, inverted by IC7c, at the input to IC6a (pin 3), but does not have any additional effect because it appears at this point simply as a continuation of the pulse which began on pin 15 of IC4. After IC5 has been through a full cycle of 16 beats and pin 15 goes low again, IC6 switches again and enables IC4.

The "start-stop" and "3/4" actions are the same as described before but require more connections to control more ICs. The circuit also shows the options suggested for the previous circuit, the down beat indicator and the start-stop touch switch.

The diode matrix represents the "recipe book" of the rhythm unit. It is not the intention of this article to provide the reader with a complete list of recipes. The reason for experimenting with rhythm units is to develop new and interesting patterns. The way to do this is to listen to a record, analyse the rhythm and to try to simulate it in the diode matrix. This takes time and patience but is great fun, especially when one plays an instrument like a piano or an organ.

In order to set up the rhythm unit with some test patterns, Table 2 gives some recipes for a 16-beat counter. Fig. 17 shows the actual diode matrix for the "rhumba" pattern in Table 2.

Rhythm selector switches are required to connect certain diode matrices to instrument simulators. For each rhythm, one multi-pole switch is needed. As explained in Part 1, such switches are difficult to buy, and expensive. For that reason it was decided to use single pole switches which control type 4016 quadruple bilateral switches. These ICs are readily available and as the four CMOS gates in each IC are individually accessible, total freedom is obtained in determination of the number of poles per selector switch.

Fig. 18 shows the "waltz" selector switch. The number of switch elements is equal to the number of instrument simulators to be activated (plus one acting as the 3/4 switch in this case). With the selector switch in the "off" position, the control inputs of the CMOS switches are kept low, causing them to be turned off. In the "on" position, the control inputs go high and each CMOS switch element now connects the appropriate diode pattern to the instrument simulators.

Continued next month

TABLE 2

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WALTZ	BD																
	SD					X				X							
	CY	X															
SLOW ROCK	BD													X			
	SD					X				X							
	CY	X		X		X		X		X		X					
SWING	BD																
	SD					X				X						X	
	CY	X		X		X		X		X		X		X		X	
ROCK	BD																
	SD					X				X							
	CY	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SAMBA	BD																
	SD					X				X							
	M	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	HC																
	LC											X					
RHUMBA	BD																
	M	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	HC																
	LC																
	CL																

BD : BASS DRUM SD : SNARE DRUM CY : CYMBALS M : MARACAS HC : HIGH CONGA
LC : LOW CONGA CL : CLAVES

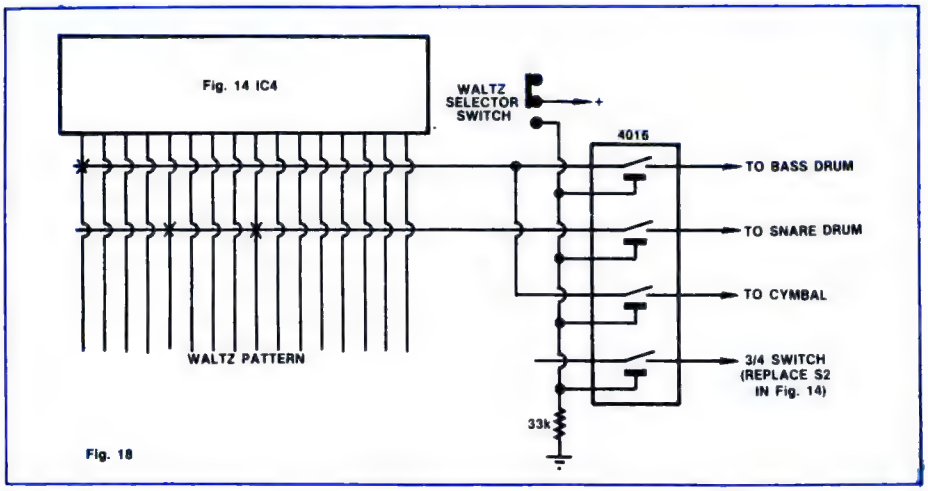
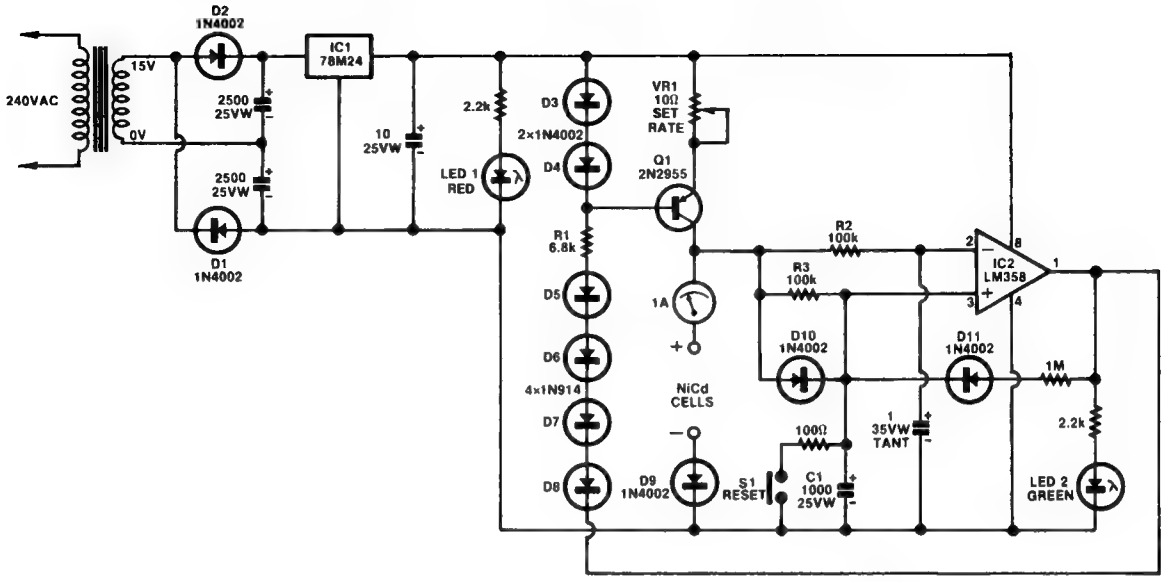


Fig. 18

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.



Constant current NiCd charger with automatic shut-off

During the charging cycle of NiCd cells, the voltage increase across them follows an upward monotonic curve. When the cells are fully charged, the voltage across them remains constant. This NiCd charger circuit detects when no further change occurs in cell voltage and automatically turns off the charger at the end of the charging cycle.

A bonus of this scheme is that the charger can automatically accommodate from one to 12 cells, since specific voltages are not detected. Only the charging rate requires manual setting.

The circuit shows a conventional constant-current charger (Q1 et al) configured so that the cell voltage to be detected is ground-referenced. Any constant-current charger could be adapted to this design.

The full-charge detector circuit employs an LM358 op amp (IC2) as a comparator in which the cell voltage is applied to the inverting input (pin 2) as a reference voltage whilst the same source applied to the non-inverting input (pin 3) is delayed by the time-constant R3.C1. As long as the reference (cell) voltage continues to increase, the non-inverting input will lag sufficiently behind the inverting input to hold the LM358 output low. The bias resistor for Q1 is thus grounded and Q1 is turned on.

When the cells are fully charged, no further cell voltage increase occurs and the reference voltage becomes static. The non-inverting input voltage will continue to rise slowly as the charge on C1 increases until the input offset voltage of the LM358 is reached (typically 2mV). The output of IC2 will then begin to rise. Positive feedback accelerates the rise and latches the output in the high state.

Current now ceases to flow through Q1's bias resistor R1, and thus Q1 turns off. Diodes D5, 6, 7, 8 provide sufficient forward voltage drop to ensure that no current can flow through R1 when pin 1 of IC2 goes high (IC2 output = Vcc −1.5V). LED 2 (green) indicates that full-charge has been reached.

The 24V regulator (IC1) is required to eliminate any effects of mains voltage variations and to limit the rail voltage to less than the 30V maximum for the LM358. No values are critical except R1. This may require adjustment to accommodate the charging rate range which is continuously adjustable from 50mA to 500mA by VR1. The range is limited only by the capacity of the power transformer used. If the charger shuts off prematurely, increase the values of R2 and R3.

Finally, take care to ensure adequate heatsinking of Q1 and IC1.

I. Board,
McDowall, Qld.

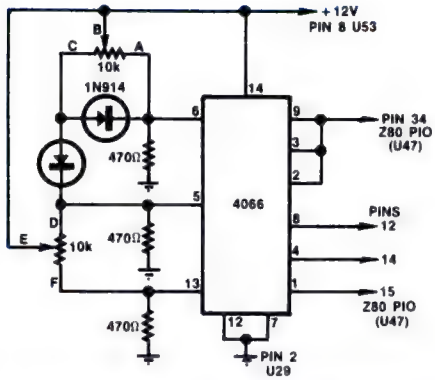
Stereo sound for TV

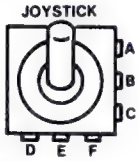
Stereo sound for TV has been the subject of much experiment and discussion over the past 12 months. Two opposing systems have been proposed: the dual carrier system used in Western Europe, and the multiplex system used in FM stereo. The technically superior two channel system has been recommended for Australia and TCN Channel 9 in Sydney has been transmitting both real and simulated stereo using this system since September 1982. The system is designed to handle mono, stereo or dual language transmissions.

The original sound channel is left untouched at 5.5MHz above the vision carrier, but, for stereo, carries the sum of the two channels (L + R). A second FM carrier at 5.742MHz above the vision carrier carries the modulation for the right channel only. The three modes (mono, stereo, dual channel) are identified by the modulation of a 54kHz subcarrier on the second sound channel.

This subcarrier is amplitude modulated to a depth of 50%, with one of the following:

(a) Mono transmission: no modulation
(b) Stereo transmission: 117.5Hz





Super-80 joystick and interface

If you need a joystick for the Super 80 Computer costing around $7.00, here is a simple circuit to interface the Tandy Electronics 40k Joystick (Cat No. 271-1706).

The circuit uses a 4066 quad bilateral switch IC. This IC has four analog switches which close when the control pin voltage is 70% of the rail voltage, and open when the pin is grounded. Pins 5, 6 an 13 are the control pins and are normally tied low by 470Ω resistors.

When the resistance of the joystick decreases, additional current flows though the 470Ω resistor(s) to ground and this, in turn, activates the analog switches. The switches are connected to the Z80 PIO in the same manner as the keyboard switches so, when using the keyboard, it is essential to have the joystick-pole centred.

For this joystick to be used with the Super 80, you will have to poke the following numbers and also set up the following USR commands.

```
FOR A=0 to 23:READ B:POKE A,B:NEXT A
DATA 62,247,24,6,62,253,24,2,62,254,1,0
DATA 0,211,248,219,250,254,127,192,1,1,0,201
```

USR COMMANDS

IF (USR(0)=1) AND (USR(4)=1) THEN.... :REM JOYSTICK POLE IS IN THE DOWN POSITION
IF USR(0)=1 THEN.... :REM JOYSTICK-POLE IS IN UP POSITION
IF USR(4)=1 THEN.... :REM JOYSTICK-POLE IS TO THE RIGHT
IF USR(8)=1 THEN.... :REM JOYSTICK-POLE IS TO THE LEFT

Here is a program to make the character "X", draw a picture on the screen with the use of the joystick.

```
10 CLS:W=271
20 FOR A=0 TO 23:READ B:POKE A,B:NEXT A
30 DATA 62,247,24,6,62,253,24,2,62,254,1
40 DATA 0,0,211,248,219,250,254,127,192,1,1,0,201
50 IF (USR(0)=1) AND (USR(4)=1) THEN 100
60 IF USR(0)=1 THEN 110
70 IF USR (4)=1 THEN 120
80 IF USR(8)=1 THEN 130
90 GOTO 50

100 L=32:GOTO 140
110 L=-32:GOTO 140
120 L=1:GOTO 140
130 L=-1
140 W=W+L
145 IF (W>511)OR(W<0) THEN W=271
150 CURS W:PRINT "X"
160 GOTO 50
```

D. Milic,
Knoxfield, Vic.

(c) Dual language: 274.1Hz

Tone decoders are normally provided to detect these tones and switch the outputs appropriately. However, readers may like to experiment with stereo reception using manual switching.

This circuit shows a simple method of obtaining stereo sound from a Philips K9 or K11 receiver. The method consists of duplicating the FM demodulator section and dematrixing the resulting (Right) output to yield Left and Right channels.

A simple demodulator is the Philips U240 module which can easily be retuned to 5.742MHz. When added to a Philips K9 or K11 receiver, the module outputs are then suitable for direct connection into a summing amplifier. The outputs of the two op-amps are Left and Right directly, and can drive line level inputs on your stereo or VCR. The prototype used an 8-pin dual MC1458 op amp IC but two 741s would be just as good.

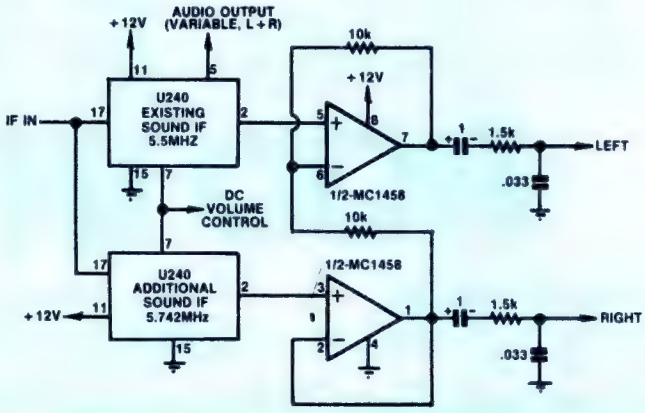
Note that pins 2 and 3 of the U240 module provide a balanced audio output at constant level. Pin 5, however, provides an audio output that varies with the remote control setting.

A standard TV IF response is designed to handle an FM sound signal at 31.375MHz, and the response includes a minimum at this frequency. Some frame buzz may be evident in the output of the second channel, and the setting of the sound IF trap may need to be changed to a frequency between the old (31.375MHz) and new (31.133MHz) sound carriers.

The alignment procedure for the additional U240 module is as follows:

- Connect an FM signal generator to pin 17. Set generator to 100μV out at 5.5MHz, modulated with 1kHz;
- Observe demodulated audio on pin 3 of module (preferably using a CRO);
- Adjust L11 and L12 for maximum audio output (see Fig.1). Adjust L10 for lowest noise/distortion;
- Retune signal generator to 5.6MHz, 5.7MHz and, finally, 5.742MHz. Adjust L11, L12 and L10 as above for each new frequency;
- Check that limiting occurs at IF input at 100-130μV;
- Set generator to 5.742MHz and 50% AM and adjust L10 for minimum demoduated audio. (Note: he shield should be fitted for this adjustment.)

A. Wyatt,
Turramurra, NSW.



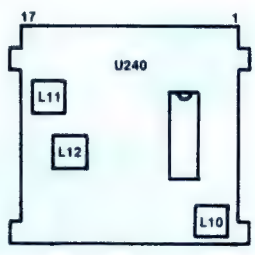


Fig. 1

WALL

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Board No	PCB Price	Description		Kit price
EA6800	$15 50	6800 Micro computer		$119.00
EA6802	$15 50	6802 Micro computer		$119.00
		Power supply to suit		$35.00
		Hex keypad 19 keys		$39.50
75L11	$2.50			
78UP10	$9.50	2650 extra ram	OCT 78	
79FE11	$3 50	Photo flash exposure mtr.	NOV 79	$24.50
79PC9	$3.90	Pulse generator	SEP 79	
79SE3	$4 90	Train model sound	MAR 79	
79TI11	$3 90	Transistor assisted ign	NOV 79	$34.50
79PS11	$2 90	Experimenters power sup.	NOV 79	
79PC12	$2.90	Fan speed control	DEC 79	
79SF10	$2 50	Photo slave flash	OCT 79	
79SF9	$2 90	Photo sound trigger	SEP 79	
79UPS6	$3 90	Universal power supply	JUN 79	$34.50
80ST10A	$3 90	Stylus timer	OCT 80	
80ST10B	$3 50		OCT 80	
80TC12	$3.90	Bipolar train controller	DEC 80	$34.50
80CM3A	$4 90	Digital capacitance mtr.	MAR 80	$49.50
80CM3B	$3.90		MAR 80	
80PG6	$7.90	TV pattern generator	JUN 80	$67.50
80TV8	$4 50	TV CRO adapter inc. p/pack	AUG 80	$39.90
80F3	$3.20	Audio prescaler	MAR 80	
80PP3	$2.50		MAR 80	
80LL7	$3.90	Leds & ladders	JUL 80	$19.50
80B7	$2.50	Beat frequency oscillator	JUL 80	
80BM10	$3.90	Car battery monitor	OCT 80	$11.50
80DC10	$6 50	Digital storage CRO ad.	NOV 80	$89 90
80HLA5	$2.90	Car headlight alarm	MAY 80	
80LS12	$3 50	Selectalott	DEC 80	$22.00
80LBR12	$2 90	Light beam relay	NOV 80	$13.00
80PC4	$2.90	Power heat controller	APR 80	
80PC7	$3.50	Power saver induc mtr	JUL 80	
80G6	$5 90	Musical tone gen.	JUN 80	
80GPS3	$2 90	Voltage regulator multi	MAR 80	
80AU3	$3.50	Hifi auto turn off	MAR 80	
80AW4	$4.50	Receiver all wave	APR 80	
80TM8A	$6.90	Digital engine analyser	AUG 80	$49.50
80TM8B	$2.90		AUG 80	
80PP7A	$8.50	Eprom programmer	JUL 80	$79 50
80PP7B	$3 90		JUL 80	
80RF5	$2 90	Rumble filter	MAY 80	
80SA3	$5 90	Playmaster stereo amp	MAR 80	
80CH7	$8 50	240V ac light chaser	JUL 80	
80RAM12	$5.90	Ram expansion for dream	DEC 80	$39.00
80PA6	$7 50	Playmaster 300W amp module		$63.00
			JUN 80	
80CL4	$3 50	Timer controller	APR 80	
80TRS11	$2 90	TRS 80 printer serial in.	NOV 80	$17 50
80SA10	$9 90	Playmaster mosfet stereo amp.		
			JAN 81	
80AD12	$3 00	Autodim light dimmer	JAN 81	$32.00
80RM12	$3 90	Cylon voice simulator	JAN 81	$19 95
80FB12	$3 90	Guitar fuzz box	FEB 81	$19 90
81SW1	$3 90	Osc. switch dual trace	FEB 81	$60.00
81SP1	$2 90	TRS 80/SYS 80Serial interf	FEB 81	
81GA3	$11 50	Color graphic analyser	MAR 81	$109 00
80GA12	$6 50	25W guitar amplifier	MAR 81	
81DC2	$3 50	Le Gong doorbell	MAR 81	$14 95
81DC3B	$8 50	Digital and	MAR 81	$189 00
81DC3A	$9.50	Analogue storage CRO	MAR 81	
81IR4	$4 50	Infra-red relay receiver	APR 81	$39 00
81RC4C	$2 90	Infra-red relay transmitter	APR 81	
81HB4A	$7 50	Heart rate monitor	APR 81	$82 00
81HB4B	$3 50		APR 81	
81MA4	$4 50	Touch sensitive alarm	APR 81	
81VM2	$2 90	High impedance DC voltmeter		
			APR 81	
81SI3	$7 90	TRS 80/SYS serial interf	APR 81	
81RC4A	$4 90	2 channel (receiver)	MAY 81	$72 00
81RC4B	$2 50	Infra-red remote (preamp)	MAY 81	
81RC4C	$2 75	Control (transmitter)	MAY 81	
81SP5	$2.90	Sound pressure meter	MAY 81	$37.00
81CC5	$2 90	PC birdies	MAY 81	$14 50
81SS4	$4 90	Speed sentry	MAY 81	
81DT5	$3 00	Dream tape controller	MAY 81	
81MP6	$3 90	Microprocessor power supply		
			MAY 81	
81AO6	$4 90	Audio oscillator	JUN 81	$59 00

Board No	PCB Price	Description		Kit price
81UA6		Benchmate power supply	JUN 81	
81MC7	$2.90	Moving coil preamp	JUL 81	
81OR7	$9.50	Electrochume (electr. organ)	JUL 81	$59.00
81P6	$2.90	Pools/lotto selector	JUL 81	$22.50
81SW7	$4.90	Electronic steam whistle	JUL 81	$17.50
81MC8	$10.90	Musicolor IV	AUG 81	$84.00
81SM7	$3.90	Bagatelle	AUG 81	
81CL9	$4.00	Digital clock/thermometer	SEP 81	$80.00
81GA9	$4.90	Photon torpedo game	SEP 81	$24.50
81UC8	$4.50	Universal timer & stpwatch	SEP 81	
81WS10	$4.90	Wind universal indicator	OCT 81	$52.50
81AO10	$3.50	Audio test unit cass. deck	OCT 81	$47.50
81SS11	$8.90	Slide cross fader	NOV 81	$99.50
81SG9	$4.20	Led sandglass	NOV 81	$22.50
81AU11	$3.90	Audible turn indicator	NOV 81	
81FM10A	$5.90	500MHZ digital freq. mtr.	DEC 81	$135.00
81FM10B	$3.90		DEC 81	
81CH12	$3.50	Christmas decoration	DEC 81	
81LD12	$4.50	Led bar graph display	DEC 81	
81MI11	$3.90	Metronome (low current)	JAN 82	
81WD12A	$3.50	Wind direction indicator	JAN 82	$24.50
81WD12B	$3.50		JAN 82	
81P19	$6.90			
82EP1	$12.50	Free standing eprom prog with '24 pin' textool socket and AC plugpack	JAN 82	$45.00 $55.00 $69.50
82TH2	$3.90	Digital thermometer	FEB 82	$79.00
82CR1	$13.50	Lge scrn storage CRO Adapt		$119.00
			FEB 82	
82EG2	$3.90	Cudlip	FEB 82	$12.95
82PS2	$4.90	Dual tracking power supply	MAR 82	$87.50
82LF2	$3.90	Low fuel indicator	MAR 82	$16.50
82CM3	$3.90	LCD capacitance meter	MAR 82	$79.00
82AO3A	$7.90	Function generator	APR 82	$79.50
82AO3B	$3.90		APR 82	
82VC3	$3.50	Voice canceller	APR 82	$22.50
82VX4	$3.50	Vox	APR 82	$15.00
82VS10				
82PT4	$3.90	Photographic timer	APR 82	$48.00
82IV5	$5.40	12-240V inverter 40 watt	MAY 82	$49 50
82P5	$5.90	Universal preamp MM/MC	MAY 82	$35.00
82TO5	$3.90	Tacho/dwell meter	MAY 82	$72.50
82TS3	$3 90	Low cost touch switch	MAY 82	$12.00
82GA5	$9 90	Guitar booster	JUN 82	$17 50
82EM6A	$4.90	Theremin	JUN 82	$34.50
82EM6B	$3.90			
82IV6	$8.90	12-240V inverter 300 watt Power monitor	JUN 82 JUL 82	$195.00 $18.00
82HB6	$3.90	LDC heart rate monitor	JUL 82	$79.00
82CC7A	$15 50	Car computer	JUL 82	$109.00
82CC7B	$4.00	Car computer	to SEP 82	
82DP6	$4.90	Decimal point for D G. meter	JUL 82	$70.00
82PA7	$9 50	Sub woofer amp	JUL 82	$85.00
82UR8	$4.90	Ultrasonic rule	AUG 82	$49.00
82MS8	$6.50	Stereo synthesizer	SEP 82	$55.00
82EF9	$4.90	Electric fence	SEP 82	$19 50
82PC8	$2 00	Fluorescent starter	OCT 82	$5.00
82FC8A	$6.50	Digital readout	OCT 82	$72 00
82FC8B	$3 90	For short wave	OCT 82	
82FC8C	$2.50	Receivers	OCT 82	
82TA10	$3.90	Freezer alarm	OCT 82	$21.00
82VS10	$7 90	Speech Synthesizer	OCT 82	
82PC10	$3 90	Power up	NOV 82	$36.00
82AL11	$3 90	Super siren	NOV 82	$23.50
82PC11	$3 90	Driveway sentry	DEC 82	$32 00
82QR12A	$9 95	Playmaster AM tuner	DEC 82	$239 00
82QR12B	$9 95		DEC 82	
82PH12	$4 90	Digital PH meter	DEC 82	$135 00
82EG12	$2 90	Boggle goggles (short form)	DEC 82	$9 60
82FD5	$4 90			
82DP6	$3 90			
83TV1A	$4.90	Remote infrared TV	JAN 83	$39 50
83TV1B	$2 90	Sound control	JAN 83	
83TV1C	$2 90		JAN 83	
83PS1	$3 90	Plugpack regulator with plugpack	JAN 83	$14 00 $29 50
83EG1	$3 50	Led head light chaser	JAN 83	$12.00
82WB1	$2 90	Wheatstone bridge	FEB 83	$45 00
82AO2	$2 90	AM tuner alignment kit	FEB 83	$8 00
		Moisture alarm	FEB 83	

Board No	PCB Price	Description		Kit price
79TI11	$3 90	Trans.ass. ignition updated	FEB 83	$34 50
83FC2		Fuel consumption meter	MAR 83	$50.00
83BP3	$3.90	Brown out protector	MAR 83	$25.00
83MS4	$3.90	Stereo simulator PCB version		$12 00
			APR 83	
		Self contained unit	AUG 83	$20.00
83PC3A	$3 90	Touch lamp dimmer	APR 83	$20 00
83PC3B	$3.50	Touch lamp timer	AUG 83	$21 00
83PS5	$4.90			
83SC7	$3 90	LCD event counter	JUL 83	$32.00
83SC8	$3.50	2MHZ digital freq meter	AUG 83	$60.00
83VA8	$5.90	Video amplifier	AUG 83	$15.00
83EG5	$4.90	Electronic roulette wheel	MAY 83	$24.00
		Electronic breath tester	MAY 83	$25.00
83PS5	$5.90	50V/5A power supply	JUNE 83	$140.00
83GA6	$7.90	Effects unit	JUNE 83	$75.00
83PP5	$5.90	Overload indicator	JUNE 83	$20.00
83PS7	$3.50	±12V for lab power supply	JULY 83	$13.00
83AL6	$2.90	Fridge door alarm	JULY 83	$9.00
83MS4	$3.90	Compumuse	AUG 83	$20.00
83WM8	$6.95	Electronic watt meter	SEPT 83	$65.00
83TT8	$3.95	Transistor tester	SEPT 83	$15.00
83MS8	$4 90	Soil heating unit	SEPT 83	$70.00
83VE10	$4.90	Video enhancer	OCT 83	$35.00
83MD9	$3 50	Nail finder	OCT 83	$10.00
83SS9	$3.90	Speed sentry	OCT 83	$11.00
ET014	$4.90	Dual voltage power supply	DEC 71	
ET043	$2.50	Heads or tails	OCT 76	$3.90
ET044	$2.50	Two tone doorbell	OCT 76	$4.90
ET047	$2.50	Morse practice set	DEC 76	$3.90
ET048	$2.50	Buzz boards	DEC 76	$4.50
ET061	$2.50	Simple audio amp	OCT 76	$5.90
ET062	$2.90	Simple AM tuner	MAR 77	$6.90
ET063	$2.90	Electronic bongos	NOV 79	$5.90
ET064	$2.50	Simple intercom	OCT 83	
ET065	$2.90	Electronic siren	DEC 79	$5.90
ET066	$2.50	Temp alarm	DEC 79	$5.50
ET067	$2.90	Singin moisture		$7.95
ET068	$2.90	Led dice	OCT 76	$6.90
ET071	$2.50	Tape noise limiter	JUN 79	
ET072	$2.50	Two octave organ	JUN 78	$9.50
ET081	$2.90	Tachometer	OCT 83	
ET083	$2.50	Train controller	DEC 79	
ET084	$2.90	Car alarm	JAN 77	$13.50
ET085	$2.50	Car over rev. alarm	OCT 79	
ET130	$2.50	Temp/volts converter	FEB 76	
ET132	$3.90	Experimenters power supply	FEB 77	
ET134	$2.90	R.M.S. voltmeter	AUG 77	
ET135	$3.50	Digital panel meter	OCT 77	
ET136	$2.90	Linear scale cap meter	MAR 78	
ET137A	$4.90	Frequency meter LCD	MAY 78	
ET137B	$3.90	Audio oscillator	MAY 78	
ET139	$2.50	Power meter	MAY 78	
ET147	$4.90	Electronic dummy load	OCT 80	$99.00
ET149	$3.50	Two tone generator	JUL 80	$34.90
ET152	$2.90	Capacitance meter	FEB 80	
ET153	$3.50	Temperature adaptor	MAY 83	$19.95
ET157	$4.90	Crystal marker	OCT 81	$37.50
ET158	$3 50	Low Ohms meter	NOV 81	$36.50
ET159	$2.90	10-15V exp. scale voltmeter	DEC 81	$26 50
		13.8V 10 amp power supply	JUL 82	
ET160	$4.90	Evaluation meter		
ET161	$4.50	0-30V var. power supply	DEC 82	$47.50
ET162	$6.50	0-40V/5A alb power supply	MAY 83	$169.00
ET163	$8 00	Zener diode tester	MAY 83	$9.00
ET164		Frequency counter	AUG 83	$16 00
ET166				
ET166B	$4 90			
ET166C	$4 90			
ET166D	$4 90	Power supply	AUG 83	$24 00
ET165	$7 50	Tacho calibrator	NOV 82	$39.50
ET245	$2 90	White line follower	NOV 77	
ET255	$2 90	Thermometer	NOV 80	
ET256	$3.50	Humidity meter	OCT 83	$29 50
		Humidity sensor	OCT 83	$19 95
ET257	$2.90	Universal relay board	MAY 81	$13 50
ET258	$2 50	Mini drill speed controller	JUL 81	$9 50
ET259A	$3.90	Versatile incremental timer	JAN 82	$39 00
ET259B	$3 90			
ET260	$2 60	Photo lamp flasher	DEC 79	

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Board No	PCB Price	Description		Kit price
ET261	$2.90	Fog horn	DEC 79	
ET263	$2.90	Simple egg timer	DEC 79	
ET264	$2.90	Simple siren	MAR 80	
ET265	$3.90	Power down	JUL 83	$37.00
ET268	$2.50	Nicad float charger	MAR 83	$9.50
ET316	$3.50	Transistor assisted ignition	MAY 77	$34.00
ET317	$3.90	Car rev monitor	JUL 77	
ET324	$4.90	Led tacho	AUG 80	$34.00
ET323	$3.90	Headlight delay	MAY 83	$17.50
ET325	$2.50	Car auto electric probe		
ET326	$2.50	Exp. scale led voltmeter	SEP 80	$12.50
ET327	$3.50	Turn/Hazard indicator	OCT 80	$22.00
ET328	$2.90	Led oil temp meter	JAN 81	$19.00
ET329	$2.50	Exp. scale vehicle ammeter	FEB 81	$19.00
ET330	$3.90	Car alarm	JUL 81	$29.00
ET332	$3.90	Electronic stethoscope	AUG 81	$34.00
ET333	$3.90	Reversing alarm	JAN 82	$10.00
ET334	$3.90	Auto tester	JAN 83	
ET335	$4.50	Windscreen wiper controller	MAR 83	
ET336	$3.90	Low cost tacho dwell	AUG 83	$24.00
ET363	$3.50			
ET417	$2.90	Overload indicator	AUG 73	
ET421		Three way (Dick Smith)	SEPT 83	
ET438	$3.90	Led level meter		$12.95
ET440	$8.50	25 Watt stereo amp	MAR 75	
ET445	$2.90	General purpose preamp	JUL 76	$8.25
ET446	$3.90	Stereo limiter	JUL 76	
ET449	$3.90	Mike preamp	MAY 77	
ET450A	$4.90	Bucket brigade	DEC 77	
ET450B	$4.90			
ET452		Guitar practice amplifier	JAN 80	
ET453	$2.90	Amp class B gen purpose	APR 80	
ET454	$3.90	Fuzz box	APR 80	
ET455	$4.50	Loud speaker protector	MAR 80	$32.50
ET457	$3.90	Scratch & rumble filter	SEP 80	$49.50
ET458	$4.90	Led level meter	JUN 81	$27.00
ET459A	$16.50	Series 5000 1/3 oct graph equ	NOV 82	$189.00
ET459B	$16.50	Graphic equ. front panel Graphic equ. metal work		
ET461	$3.90	Balanced input preamp	DEC 82	$20.00
ET464	$2.90	IC audio amplifier	JUL 83	$8.00
ET465	$4.50	Loud Hailer	JUL 83	$50.00
ET466	$8.50	300W amp module	FEB 80	$67.50
ET467	$6.90	4 input mike preamp	JUL 80	$29.50
ET470	$4.50	60 watt amp module series 4000	TPV 6	$26.00
ET471	$9.90	Audio preamp series 4000 Series 4000 front panel Series 4000 metal work	TPV 6	$49.50 $14.90
ET472	$4.50	Power supply for series 4000	TPV 6	$24.00
ET473	$5.90	Moving coil preamp series 4000	TPV 6	$54.00
ET474	$2.90	Interface 60W amp	JAN 80	
ET475	$6.90	AM tuner	SEP 80	$99.00
		Set of three pot cores		$29.50
ET476	$7.90	Series 3000 amp 25W stereo	NOV 80	$84.00
ET477	$7.90	Series 5000 pwr. amp mod 150W	JAN 81	$63.50
		Series 5000 power amp complete kit Series 5000 pwr amp front panel Series 5000 pwr amp metal work		$299.00
ET478MB	$13.90	Series 5000 preamp main brd OCT 81		
ET478MC	$4.90	Moving coil preamp (5000)	SEP 81	$24.50
ET478MM	$4.90	Moving magnet preamp (5000)	SEP 81	$18.50
ET478SA	$2.90	Series 5000 preamp switch brd	OCT 81	
ET478SB	$1.90	Series 5000 preamp switch brd	OCT 81	
ET478SC	$1.90	Series 5000 preamp switch brd	OCT 81	
ET478SD	$1.90	Series 5000 preamp switch brd	OCT 81	
ET479	$3.50	Series 5000 bridging adaptor	MAR 82	$12.90
		Series 5000 preamp complete kit		$259.00
		Series 5000 preamp front panel		
		Series 5000 preamp metal work		
ET480	$4.50	100 watt amp module	30 AP	$25.50
ET480PS	$4.50	50-100W amp module pwr supply	30 AP	$22.50
ET481M	$3.95	Hi-power p.a./guitar amp mod.	30 AP	
ET481PS	$4.90	12V/100 p.a. inverter	30 AP	
ET483	$4.50	Sound level meter	FEB 78	
ET484	$5.90	Expander compressor 30 AP	JUL 77	
ET485	$5.25	Graphic equaliser	JUN 77	
ET486	$4.90	Howl round stabilizer	NOV 77	$59.00
ET488	$7.90	60W amp module	JAN 83	
ET489A	$3.50	Audio spectrum analyser no2	APR 78	
ET489B	$3.50			
ET492	$3.90	Sound bender	FEB 82	$29.00
ET494	$3.90	Loud speaker protector	OCT 82	$24.50
ET496	$8.90	Series 4000-1 speaker kit	FEB 80	$749.00
		Speakers & crossovers		$499.00
		Crossover kits		$199.00
		Speaker boxes (prices per pair)		$269.00
ET499	$4.95	50W mosfet amp 75-85	MAR 82	$79.00
		Transformer		$43.50
		Anodised heatsink		$42.50
ET525	$4.90			
ET527	$5.90			
ET528	$2.90	Intruder alarm	JAN 75	
ET539	$3.90	Touch switch	MAR 76	
ET541	$3.90	Train controller	MAY 76	
ET547	$3.50	Telephone bell extension	JUN 77	
ET549A	$3.90	Metal detector	MAY 77	
ET560	$2.50	240V mains locator	MAY 80	
ET561	$3.90	Metal Detector	MAR 80	$34.00
ET562	$3.90	Geiger counter	APR 80	
ET563	$4.50	Nicad fast charger	JUL 80	$59.95
ET566A	$2.90	Pipe & cable locator	APR 80	
ET566B	$4.90			
ET567	$4.50	Core balance relay	APR 81	$44.50
ET568	$2.90	Photo flash trigger	OCT 80	$26.50
ET570A	$2.90	Infrared 'trip' relay TX	JAN 82	$24.50
ET570B	$3.20	Infrared 'trip' relay RX	JAN 82	
ET572	$4.90	Digital pH meter with probe	DEC 80	$109.00
ET573	$4.50	Universal timer	OCT 79	
ET575	$2.90			
ET576	$8.90	Electromygram	TPV 6	$95.00
ET577	$3.50	General purpose power supply	TPV 6	$39.50
ET578	$3.90	Simple nicad charger	JUN 80	
ET581	$3.25	15V dual power supply	JUN 76	$17.50
ET583	$2.90	Marine gas alarm	AUG 77	
ET585R	$2.90	Ultrasonic receiver	TPV 6	$17.95
ET585T	$2.90	Ultrasonic transmitter	TPV 6	$10.95
ET586				
ET596	$2.90	White noise generator	NOV 81	$8.00
ET598A	$3.90	Touch switch	FEB 81	$10.00
ET598B	$3.50			
ET599A	$3.50	Infra red remote control	MAY 80	$76.00
ET599B	$3.50			
ET599C	$4.90			
ET599D	$3.20	I.R. remote cntrl power supply	MAY 80	
ET603	$4.90	Music synthesizer sequencer	AUG 77	
ET604	$4.50	Metronome	SEP 77	
ET606	$3.90	Electronic tuning fork	NOV 79	
ET607A	$2.90	Sound Effects generator	AUG 81	$12.50
ET607nf	$2.90		AUG 81	
ET631-2	$7.50	Keyboard encoder	APR 77	
ET635	$4.90	Computer power supply	APR 81	
ET636	$19.90	7 slott s100 mother board	MAY 80	$89.50
ET638A	$5.90	Eprom programmer	JUL 78	
ET640	$69.00	Memory mapped VDU		$129.00
ET644	$69.00	Direct connect modem	OCT 82	$169.00
ET646A	$3.75			
ET646B	$3.75			
ET647		Speech synthesizer	OCT 82	
ET649		Microbee light pen	AUG 83	$19.95
ET650A	$4.90	Stac timer	NOV 78	
ET650B	$4.50			
ET650C	$4.50			
ET653	$6.50	16 Channel comp output driver	NOV 82	$45.00
ET654	$69.00	Gen. purp. interface for Apple	MAR 83	$169.00
ET660	$19.00	Learners microcomputer	OCT 81	$99.00
		Key set (18) to suit ET660		$30.00
		Colour option kit to suit 660		$16.50
ET668	$5.90	Microbee eprom programmer	FEB 83	$38.00
		With textool socket		$47.50
ET670	$11.00	Low cost micro keyboard	MAY 82	
ET682	$79.00	Versatile eprom card	MAY 81	$115.00
ET686	$9.50	ppi-based eprom programmer	OCT 82	$48.00
ET688A	$3.50	Bipolar prom programmer	JUL 83	$48.50
ET688B	$3.50			
ET708	$2.90	Aerial amp	MAR 76	
ET713	$4.90	FM tuner add on	SEP 77	
ET717	$4.90	Crosshatch generator	MAY 78	
ET724	$3.90	Microwave leak detector		$16.50
ET726	$3.50	R.F. amp 70W 6/10 meter	FEB 80	
ET729	$3.90	UHF TV masthead amp	APR 81	$36.00
ET730		UHF TV converter	MAY 81	$37.50
ET731	$4.50	Teletype modulator	OCT 79	
ET733	$4.90	RTTY computer decoder	APR 83	$20.00
ET734	$7.90	Phoney patch	MAY 83	$65.00
ET735	$4.90	UHF to VHF convertor	MAY 81	
ET736	$3.90	Radio facs pict-comp decoder	SEPT 83	$25.00
ET760	$3.90	Video mod to suit 660 micro	OCT 81	$15.50
ET824	$3.90	Slot car power supply	DEC 81	$19.50
ET825	$5.90	Slot car contr. (no case)	DEC 81	$59.00
ET905	$16.00	Polyphonic organ	JAN 83	
ET918	$3.90			
ET1501A	$2.90	Negative ion generator	APR 81	$39.00
ET1501B	$2.90			
ET1501C	$2.00			
ET1503	$3.90	Battery charger	AUG 81	
ET1505	$5.90	12V fluoro. inverter	AUG 82	$49.50
ET1506	$2.90			
ET1509	$4.90	D.C.-D.C. inverter	SEP 82	$39.50
ET1510A	$3.90	Model railway points	JAN 83	
ET1510B	$2.90	Controller and indicators		
ET1511	$3.90	Immersible temp controller	FEB 83	$19.50
ET1512	$4.25	Electric fence tester	FEB 83	$24.50
ET1515	$3.95	Motor speed controller	APR 83	$27.50
ET1516	$3.90	Model engine ignition system		$41.50
ET1517	$3.75	Video distribution amp	SEP 83	$45.00
ET1520	$3.90	Wideboard amp	JUL 83	$37.00
Hobby Electronics				
HE102	$4.50	Guitar phaser	JUN 81	$25.00
HE103		Transistor tester		$9.40
HE104	$3.90	A.M. tuner	MAY 81	$7.50
HE105	$3.90	Basic amplifier	MAY 81	$9.50
HE106	$3.90	F.M. radio microphone	MAY 81	$8.50
HE107	$3.90	Electronic dice	JUN 81	$5.95
HE108	$3.90	Power supply		$11.95
HE110		Unmistakabell		$6.90
HE111		Ohmeter		$19.90
HE112	$3.20	Micromixer		$11.90
HE113	$3.50	Water alarm		$9.45
HE114	$3.90	Digital counter	OCT 81	$14.50
HE115	$2.90	Reaction timer		
HE116	$3.90			
HE117	$3.90	House and car alarm		$16.90
HE121	$2.90	Scratch and hiss filter		$9.00
HE122				
HE123	$4.50	Alien invaders		
HE126	$3.50	Nicad charger (P Pack ex $9.95)		
HE127		Siren		$3.90
HE128		Fog horn		
HE129	$3.50	Simple tuner		

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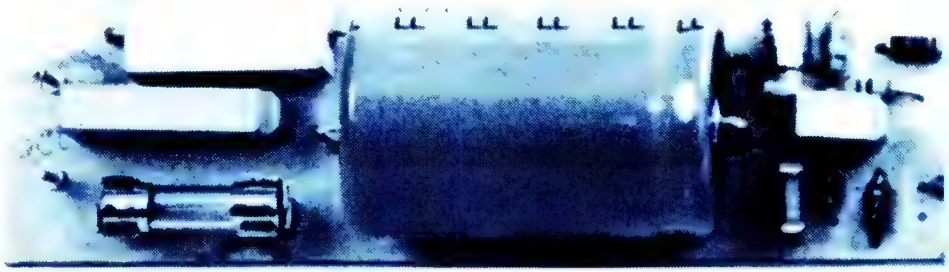
Electronic ballast circuits for fluorescent lamps have recently become widely used in Europe and a similar trend is expected in Australia in the future. Siemens Ltd, a German company, have supplied us with a working prototype module for evalution. What advantage does it have over the conventional circuit and how does it work?



Features of electronic ballasts are many and impressive. They offer instant tube starting, and absence of flicker due to the high operating frequency. Also they will drive more than one tube, produce no audible hum, and do not require power factor correction. Their efficiency is also greatly increased. Losses are up to 60% lower than the ballast losses of a conventional system, while the higher operating frequency increases light output of the fluorescent lamp by up to 15%. By using Siemens' new, more efficient "Lumilux" fluorescent tubes even further power savings can be obtained.

They do have one drawback, however, and that is a much higher initial cost when compared to conventional ballast/starter systems. For this reason this article is presented as one of general interest only. It should not be regarded as a constructional article, as the cost to hobbyists of mains-rated power FETs is currently too high to make the circuit an economic proposition.

Basically, the electronic system comprises a DC power supply derived by rectifying and filtering the AC mains waveform and a solid state high frequency oscillator driving the tubes via small chokes. High voltage Metal Oxide Semiconductor Field Effect Transistors, MOSFETs, are used as the oscillator drivers.

Before delving into this electronic ballast circuitry, a discussion of the conventional ballast and starter circuit will enable us to compare the advantages and disadvantages of each system. Fig. 1 shows the circuit for a conventional fluorescent starter circuit. This basically consists of the ballast and starter. We shall ignore the capacitor connected across the mains for the present.

When power is first applied, a small current flows through the ballast, tube filaments, and starter. The starter is filled with an inert gas. This ionises and the resultant heating of the gas causes the bimetallic contact within the starter to close. A heavier current then flows through the tube filaments and ballast.

The tube filaments heat and begin to emit electrons. At the same time the starter cools and the bimetallic contact opens and interrupts the filament current. The resulting back EMF from the ballast generates a large peak voltage which ignites the tube. When the electric discharge is established in the fluorescent tube, it has a very low resistance and the ballast inductance is needed to limit the maximum current supplied to the tube.

In normal operation, the tube ignites and extinguishes during every mains half cycle so that it actually flashes at 100Hz. Note that the .005μF capacitor across the starter suppresses RF interference caused by the starter contact opening and the discharge within in the tube itself.

The advantages of this system are simplicity, economy and ready availability. Now for the disadvantages: Firstly there is the starting characteristic. Typically at first turn on, the starter needs several attempts to ignite the tube resulting in a slow and flickering start. The second disadvantage occurs when the tube approaches the end of its life when lamp-end flicker becomes a problem. Thirdly, there is the need to replace the starter periodically since it has a limited life.

Other disadvantages concern the choke. Due to iron core losses and the resistive (I^2R) losses in the windings, power is consumed by the choke. Iron core losses are very small compared to these I^2R losses and can be neglected. A typical low loss choke for a 40W fluorescent tube dissipates between 5 and 8W. This means that about 11% of a fluorescent light power bill is used in heating the choke.

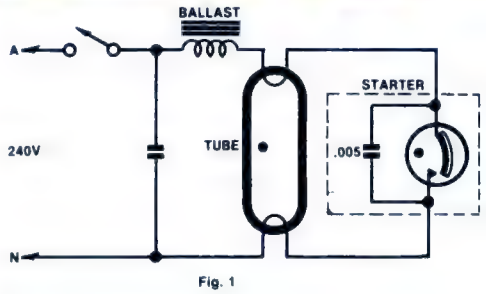


Fig. 1

The conventional fluorescent starter circuit is simple and economical but also has disadvantages, including high power consumption.

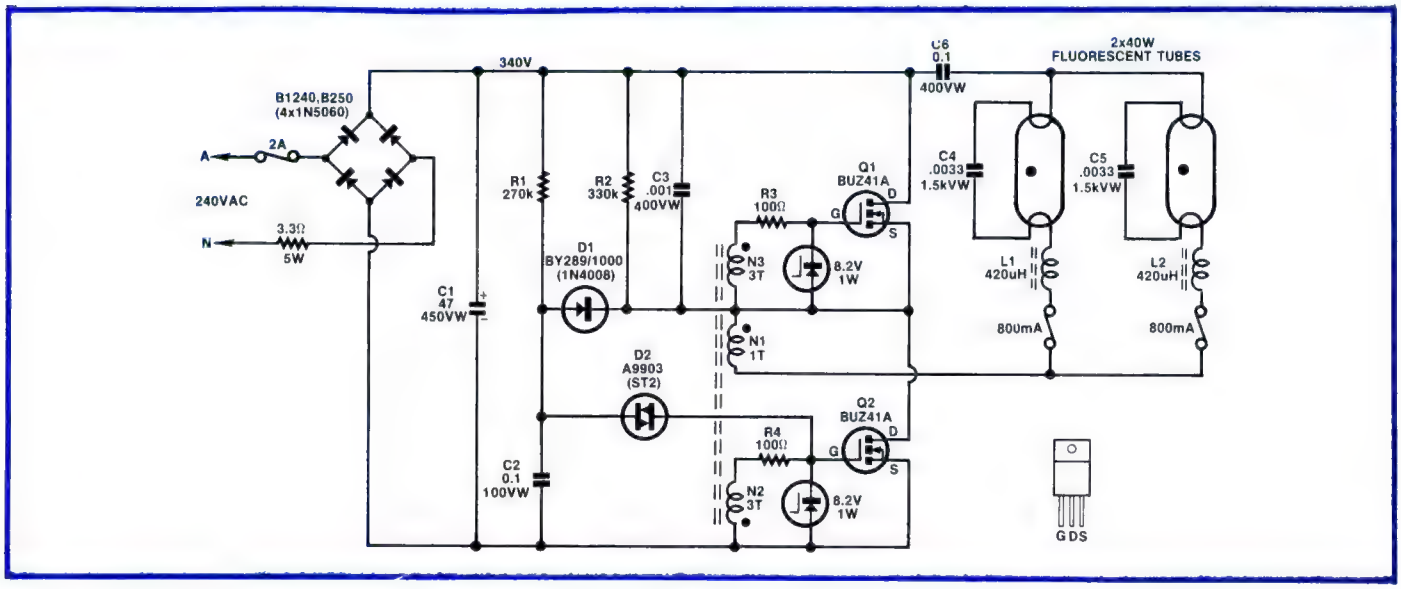
Power factor

In general a 40W fluorescent tube is supplied with about 416mA and has 96V RMS across it. This same current passes through the choke but, due to its inductance, the current lags behind the voltage. At the active and neutral terminals the power factor (the cosine of the angle between the current and voltage) is typically 0.48. Now we can calculate the power dissipated by the combination of tube and choke. The formula is E × I × power factor. So we have 240V × 0.416A × 0.48 = 47.9W. Since 40W is consumed in the tube, the choke dissipates the remaining 7.9W.

By connecting a capacitor across the active and neutral terminals the power factor is improved since the capacitor provides a current leading the voltage. If the capacitor were made large enough

fluorescent lamps

efficiency and greater light output



the lagging current of the inductor would be cancelled by the leading current of the capacitor. A 3.5μF capacitor improves the power factor to 0.85. Now the line current reduces to 235mA, and the phase between the current and voltage is much closer than without the capacitor.

Recalculating the power dissipated in the choke and tube, we obtain, 240V × 0.235A × 0.85 = 47.9W. Again 40W is consumed in the tube and 7.9W dissipated in the choke, but the significant point is that the line current is reduced to 235mA.

This reduction in the line current may not at first appear important since after all the same power is used regardless of power factor. However, the line current contributes to I^2R losses in the incoming supply lines. Consequently the lower the line current the lower these losses become. (And remember this is a square law.) These losses do not affect the consumer directly, although, the electricity supply authorities are interested in keeping the power factor as close to unity as possible. This reduces losses within their alternators, transformers and supply lines.

By contrast, the electronic ballast appears to solve every problem inherent in the conventional ballast system but with a few advantages and disadvantages of its own. Because of the very high frequency of operation, the electronic ballast provides virtually instant starting and complete freedom from visible lamp flicker. The high operating frequency also allows the use of smaller and more efficient chokes which reduce circuit losses and allow a more compact lamp housing.

The very much higher operating frequency (around 120kHz) should also minimise strobing effects which, in the past, have prevented the use of fluorescent lights in some factory situations. Strobing effects can make rapidly rotating machinery appear to be stationary or rotating very slowly, and thus create a safety hazard. While strobing can still theoretically occur, even at 120kHz, the risk of it matching typical machine speeds would seem to be minimal.

The lack of audible hum will probably also mean that recording studios which previously would not use fluorescent lights can now install them and obtain energy savings.

Electronic starter circuit

Circuitry for the electronic ballast consists of a DC power supply, an oscillator comprising MOSFETs, Q1 and Q2 and associated components, and the current limiting chokes, L1 and L2, for the tubes. This circuit is for driving two 40W fluorescent tubes.

A 340V DC power supply is derived by full wave rectifying the mains voltage and filtering with the 47μF/450VW capacitor, C1. A 3.3Ω resistor connected in series with the AC supply limits the

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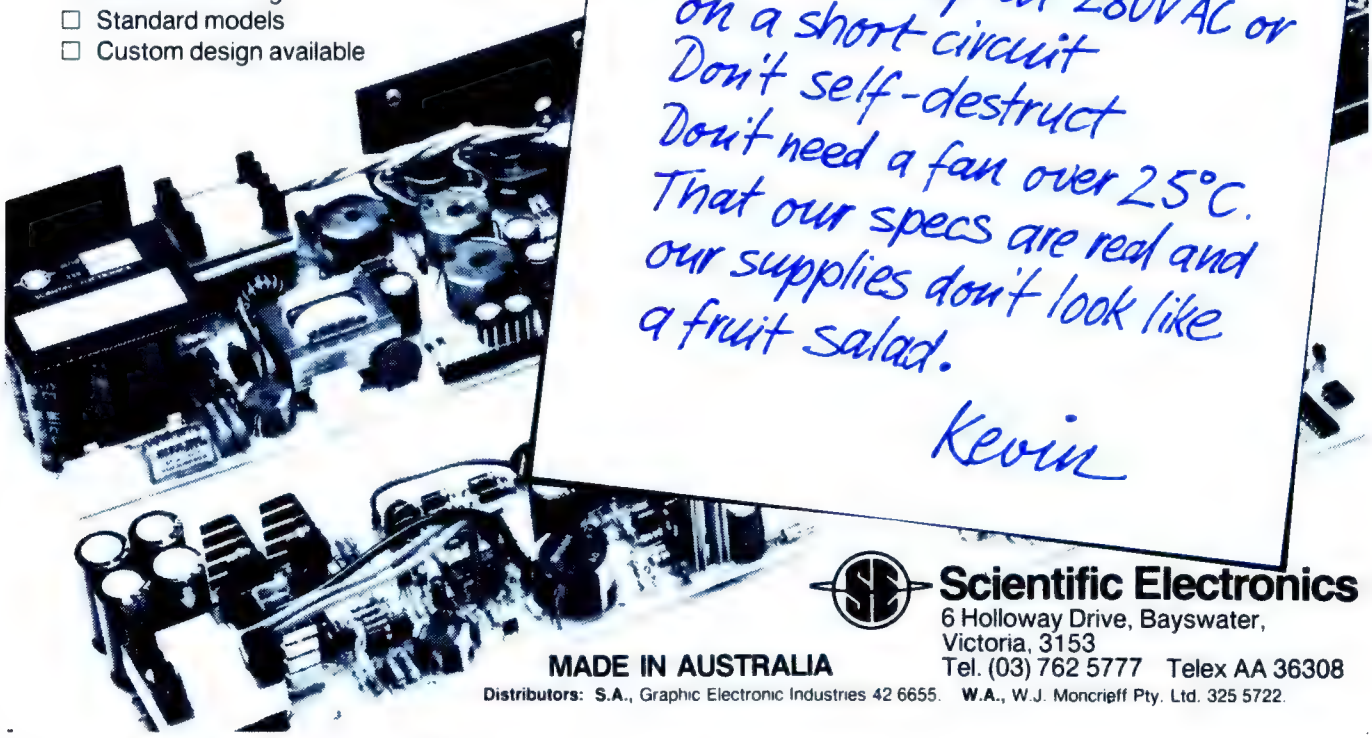

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Electronic ballast for fluorescent lamps

surge current through the diodes when power is first switched on.

At first switch on, C2 begins to charge via R1. When the voltage across C2 reaches about 32V (after about 3ms), Diac D2 breaks down and conducts current from C2 into the gate of Q2. Q2 then turns on and generates a current pulse through the N1 coil of the transformer, L1 and L2, the heater windings of the tubes, C4 and C5, and finally C6.

Back EMF

Once C2 is discharged, gate current no longer flows and Q2 turns off. L1 and L2 now produce a high voltage back EMF due to the interruption of current flow. Provided the heaters are sufficiently warm to support continuous ionisation, the tubes will ignite. If not then the cycle will begin again to further raise the heater temperature. Capacitor C2 charges and dumps current into the gate of Q2 which again turns on, pulsing current through the tube heaters and L1 and L2.

This process continues until the tubes light. The resultant heavier current flowing through N1 of the transformer induces voltages in both N2 and N3 windings sufficient to trigger the gates of Q2 and Q1 respectively. N2 and N3 are connected out of phase and the negative voltage from N2 to the gate of Q2 switches Q2 off. The positive voltage from N3 switches Q1 on. Current now flows in the opposite direction through C6, the tubes, L1 and L2, the coil N1 and MOSFET Q1. Capacitor C6 now begins to discharge.

This reversed current flow through N1 induces positive gate voltage at N2, turning Q2 on again. The negative gate voltage at N3 turns Q1 off. C6 now begins to charge since the current through N1 is once again reversed.

High frequency oscillator

The circuit now operates as a high frequency 120kHz oscillator with L1, L2 and C4 and C5 controlling the free running frequency. L1 and L2 also are used to limit the current supplied to each fluorescent tube. Each time Q2 is on, C2 is discharged via diode D1 so that the Diac, D2, is kept from firing.

The zener diodes between the gate and source of each MOSFET, Q1 and Q2, limit the maximum Vgs voltage while the 100Ω resistor in series with each transformer winding limits the zener current.

If the tubes are removed from the circuit, R2 and C3 are used as the load for Q2. This keeps the circuit operating with D2 triggering Q2 and Q1 remaining off. The circuit is ready to start the tubes should the power be on while the tubes are installed.

Note that the chokes are quite small. These are iron cored with a 2.5mm air gap which prevents the core saturating. A 10mm diameter ferrite toroid is used for the transformer core to support the N1, N2 and N3 windings. The MOSFETs used are SIPMOS (Siemens Power MOS) BUZ41A, and these are mounted on small heatsinks to aid heat dissipation.

Performance of the electronic ballast is quite impressive. The instant start of the fluorescent tube and the lack of flicker are immediately obvious. When power is switched off, the brightness of the tube gradually dims until it extinguishes. This is due to storage in the DC power supply.

Some of the efficiency can be credited to the slightly increased light output from a fluorescent tube when operated at a high frequency. Power savings are also had by the use of the small chokes. These are low loss due to the large wire diameter and small number of turns around a small core. They can be small and still provide the necessary current limiting since operation is at a high frequency.

The high frequency of operation can cause problems with electromagnetic interference (EMI). We made comparisons of the interference caused to medium and shortwave radio reception by electronic and conventionally ballasted fluorescent lamps in the near vicinity to a receiver. While not rigorous, these tests showed that the levels of radiated interference were comparable.

Current waveform

A related problem is the shape of the current waveform for the electronic ballast circuit. While the electronic ballast does not require a power factor correction capacitor as does the conventional ballast there is still a problem for the energy supply authorities in that the rectifier uses a capacitive-input filter. This means that the current waveform is in the form of a short duration pulse at the peak of each mains half-cycle. The result is distortion of the mains waveform and the generation of unwanted harmonics.

For commercial users though, the large scale use of electronic ballasts will lead to large savings in annual office and factory lighting bills.

Anyone requiring further information should direct their enquiries to Siemens Ltd, 383 Pacific Highway, Artarmon, NSW, 2064, or 544 Church St, Richmond, Victoria, 3121.

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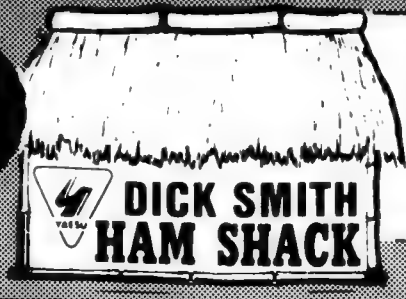

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See Page 120 for full address details

At the rear of the Model 100 are connections for an RS232C serial interface, parallel printer and cassette recorder.

TANDY MODEL 100 PORTABLE COMPUTER

First of the new generation

The TRS-80 Model 100 is one of a new breed of portable computers — significant not so much for what they offer (although that is considerable) as for the possibilities they foreshadow.

by PETER VERNON

Not many years ago Isaac Asimov wrote science fiction stories about portable "information processors" which were all things to all users. While the advent of the wristwatch computer is still some time away, portables such as the Model 100 are pointing the way.

Not much bigger than a slim encyclopaedia volume (300 x 215 x 40mm W x D x H) and weighing 1.7kg, the Model 100 comes with a full-size typewriter style keyboard and a 40-column by 8-line liquid crystal display. Software is built-in, with a powerful Microsoft Basic interpreter, word processing, appointments file, communications and address filing programs. Four penlight batteries provide sufficient power for around 20 hours of operation, with a red LED indicator on the top right of the console which lights to show that the batteries should be changed. Alternatively, when the Model 100 is not used "on the go" power can be supplied by a 6VDC plugpack adapter.

The 56-key keyboard is easy to use thanks to its size and clearly labelled black and white keytops. While it is flat, rather than stepped (with the rows of keys on different levels), it is both comfortable and compact, a rare combination.

Above the main keyboard are 16 smaller keys, comprising eight programmable function keys, four special purpose word processing functions and four cursor control keys.

Above these is the 8-line by 40 character LCD screen, capable of displaying both upper and lower case alphanumeric characters plus graphics. A control on the right side of the console adjusts the display for optimum contrast from a specific viewing angle, although overhead lighting can still cause problems in this respect. There is an advantage however – with the display adjusted for best viewing by a user seated in front of the machine, so no one can read over your shoulder.

The 40 column display is more readable than most LCDs because of the large, fully-formed characters. It also

TRS-80 Model 100 Basic statements and functions

ABS, ASC, ATN, BEEP, CALL, CDBL, CHR$, CINT, CLEAR, CLOAD, CLOAD?, CLOADM, CLS, CLOSE, CONT, COS, CSAVE, CSAVEM, CSNG, CSRLIN, DATA, DATE$, DAY$, DEFDBL, DEFINT, DEFSNG, DEFSTR, DIM, EDIT, END, EOF, ERL, ERR, ERROR, EXP, FIX, FOR. . .NEXT, FRE, GOSUB, GOTO, HIMEN, IF. . .THEN, INKEY$, INP, INPUT, INPUT#, INPUT$, INSTR, INT, IPL, KEY, KEY LIST, KEY ON;OFF, KEY STOP, KILL, LCOPY, LEFT$, LEN, LET, LINE, LINE INPUT, LIST, LLIST, LOAD, LOADM, LPOS, LPRINT, LPRINT USING, LOG, MAXFILES, MENU, MERGE, MID$, MID$=, MOTOR, NAME, NEW, ON ERROR GOTO, ON KEY GOSUB, ON TIME$ GOSUB, ON. . .GOTO, ON. . .GOSUB, OPEN, OUT, PEEK, POKE, POWER, POS, POWER, CONT, POWER OFF, PRESET, PRINT, PRINT@, PRINT#, PRINT USING, PSET, RESUME, READ, REM, RESTORE, RESUME, RETURN, RIGHT$, RND, RUN, RUNM, SAVE, SAVEM, SCREEN, SGN, SIN, SOUND, SPACE$, SQR, STOP, STR$, STRING$, TAB, TAN, TIME$, TIME ON;OFF; STOP, VAL, VARPTR.

Tandy's Model 100 portable computer comes with five built-in programs and the capacity to store many more files.

seems to suffer less from "access flicker" than the 80 column displays now becoming available. Naturally it is not as fast as a video display, and in fact typing at moderate speed can outrun the display (although not the keyboard buffer). It is a strange experience at first to finish typing a line and then watch as the letters appear one by one across the screen.

The Model 100 has an array of graphics symbols, Greek characters and special mathematical and typesetting symbols which can be accessed from the keyboard using the GRPH key in conjunction with the standard keys. In addition the full ASCII character set and control codes to be produced from the keyboard using the CODE key, and for those who prefer a numeric keypad a locking NUM key converts letter keys on the right side of the keyboard to allow fast entry of numeric data.

On the right side of the Model 100 console is a power switch, the display control mentioned above and an input for 6V DC from a plugpack adapter. A socket for the connection of a bar-code scanner is on the left, while the rear has a reset button, RS232C connector, a Centronics standard parallel printer connection and a connection for a cassette recorder. The serial interface is a standard 25-pin D-type connector while the printer port connection consists of two rows of pins on 2.54mm centres and requires a special purpose printer cable. Underneath the console is a plastic cover which conceals a 40-pin expansion connector and a socket for additional ROM, the battery compartment and a power switch for the separate Nicad batteries which power the memory of the Model 100. Normally this switch is in the On position, even when changing the main batteries. Switching it off will clear the entire memory.

Processor and memory

The Model 100 is based on the 80C85, a CMOS (low power) version of the Intel 8085. Except for differences in interrupt handling, the machine language for this processor is identical to that of the 8080 so additional software should quickly become available. Clock speed is 2.4MHz, giving the Model 100 a respectable performance, and memory can be expanded in increments of 8K to a maximum of 32K available to the programmer.

To conserve the batteries an automatic power-down feature will switch the computer off after 10 minutes without a keyboard entry, unless a program is running. Ten minutes is the default — from Basic the period can be set anywhere from one minute to around 22 minutes.

When first switched on, the Model 100 displays a menu of built-in software and existing user files (if any), the date and time and the amount of memory remaining. Files may be of one of three types, identified by two letter extensions following the six character file name. Basic programs are suffixed with a .BA, data and word processor files with .DO and machine language programs with .CO. A particular file is activated by moving the cursor over the file name and pressing Enter, or by typing the name of the required file in response to a prompt on the bottom line of the menu display.

If the user has previously stored a file in memory two options are available. To activate a Basic program, for example, the user can activate Basic and load the file in the normal way, or move the cursor over the file name of the program and press Enter. Initiating a Basic

TANDY MODEL 100 PORTABLE COMPUTER

program in this way automatically activates the Basic interpreter, while if a data file is selected the word processor, TEXT, will be activated.

The address filing program and appointments scheduler cannot be entered unless a file of names and addresses or appointments information respectively has previously been created with the text editor and stored under the name ADRS.DO (for addresses) or NOTE.DO (for appointments).

Model 100 Basic

The Basic of the Model 100 has some similarities to that of other TRS-80 machines – not surprising, since all are from the Microsoft stable – but includes additional capabilities in keeping with the special requirements of the integrated software system.

Model 100 Basic is especially strong on interrupt handling and input/output, with full support for the serial and parallel ports, function keys and clock/calendar of the portable. Other statements control the power supply, and it is possible to write a program which actually turns off the computer, and to specify that execution will continue when power is restored (the POWER OFF, RESUME statement). By using the statement IPL a program can also be made to run automatically when the computer is switched on.

The function keys of the Model 100 are supported by statements which allow each programmable key to be associated with a string of up to 15 characters, as in;

```
KEY1,"?DATE$"+CHR$(13)
```

Once this statement has been executed, pressing function key F1 is equivalent to typing the definition and will display the current date. The question mark is equivalent to the PRINT statement and CHR$(13) is the carriage return character which activates the definition. The statement KEY LIST will display the current definitions of all eight function keys.

The function keys can also be used to create a processor interrupt and re-direct the flow of program control. Key interrupts are enabled by the statement KEY ON and associated with particular subroutines by the ON KEY GOSUB statement, which is followed by up to eight line numbers. Function key F1 will direct the program to the first line number, F2 to the second line number and so on.

The clock and communications ports can use interrupts in the same way, so that, for example, ON TIME$="time" GOSUB (line) will jump to a subroutine when the time matches that set in the statement. ON COM GOSUB, on the other hand, causes a branch to a specified subroutine whenever incoming data is detected at the RS232C port.

Basic is also fully integrated with the other software of the Model 100 and can read and write data files created and edited by the TEXT word processor. Input and output can also be re-directed between a cassette recorder, RAM and the communications port or output sent to the parallel printer under program control. The default for I/O operations is the battery-backed up RAM of the machine, so that, for example, SAVE "Prog1" will store a Basic program in memory, adding its name to the menu which appears on start-up. SAVE"CAS:Prog1" will store a program on the external cassette recorder, and SAVE"LPT:Prog1" will send the program to the parallel printer. Other options are LCD (for the screen) and COM (send a program via the RS232C communications port).

At any time the Basic statement MENU will return the user to the initial menu of options shown on power up.

An unexpected feature of the Model 100 is its support for graphics and sound effects. The LCD screen can be considered as a matrix of 240 x 64 points and individual pixels turned on and off with the statements PSET and PRESET. The LINE statement is also available to allow lines to be drawn between specified points, or with the options B and F, to draw boxes on a specified diagonal with an optional fill. In addition to graphics there is an array of screen formatting and PRINT statements including PRINT@ and PRINT USING, allowing total control over the screen display.

Sounds are specified with the statement SOUND freq, time, which will produce a tone of the specified frequency for a set period. The frequency parameter must be between 0 and 16383, providing a five octave range, while time is specified in increments of 1/50th of a second. The BEEP statement simply produces a fixed tone, while SOUND ON/OFF is available to activate a tone to indicate the progress of program loading from a cassette recorder.

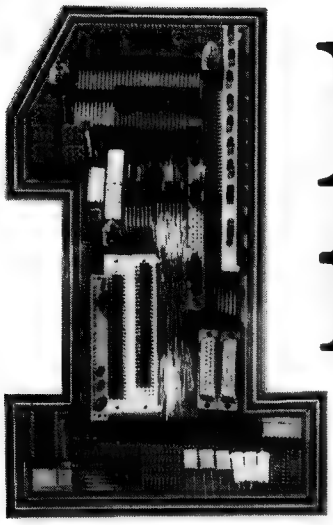
Machine language routines can be executed with the statement CALL, which jumps to a machine language routine at a specified address and allows two parameters to be passed. PEEK and POKE are available for direct manipulation of the Model 100's memory, and VARPTR can be used to locate the address of a particular variable for use with machine language programs. Machine code routines can also be saved and loaded from cassette or RAM with the commands SAVEM and LOADM, or loaded and run automatically with RUNM, but as yet there is no monitor program to allow easy entry of hexadecimal codes.

Error-trapping is provided with the statements ERL (returns the number of a line in which an error appears), ERR (returns the error code), ON ERROR GOTO and ERROR (which allows an error to be simulated when testing a program).

Program editing is not as straight-forward as in previous TRS-80

TRS-80 Model 100 specifications

Processor	80C85
RAM	Up to 32K in 8K increments
ROM	32K
Interfaces	Parallel printer port, RS232C serial port
	Cassette recorder
	Bar code scanner
	Expansion interface
Keyboard	56 keys, typewriter style
Display	Liquid crystal
	40 x 8 lines text
	240 x 64 graphics
Sound	Single voice
	Five octave range
Software	Microsoft Basic
	Text editor
	Communications
	Address filing
	Schedule filing
Documentation	Excellent



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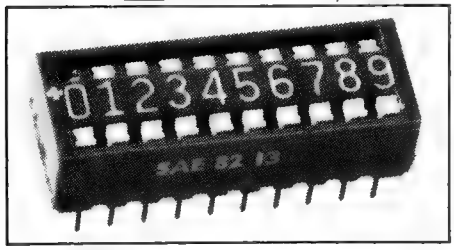

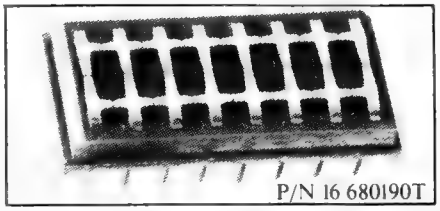

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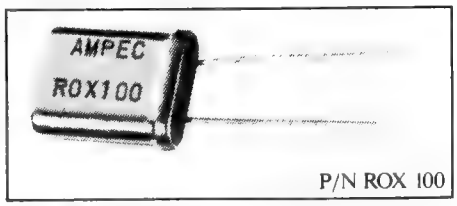

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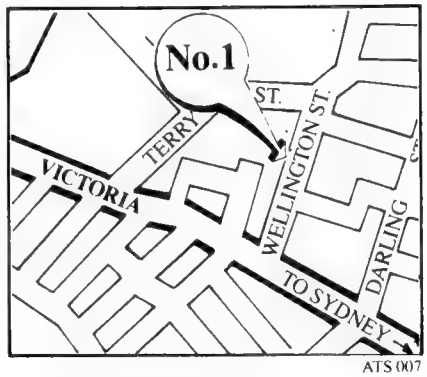


ATS 007

computers. First of all, typing EDIT (line number) puts the user in the word processing mode, with the specified line appearing at the top of the screen. Editing is then performed by using the word processing functions to insert and delete characters etc. Pressing ENTER however will not return the user to Basic but simply inserts a carriage return in the line being edited. To return to Basic it is necessary to press F8, the function key normally defined as "menu". If the edited line is now acceptable to Basic all is well and programming can continue. If the line is still in error the message "TEXT ILL-FORMED" will be displayed.

Unless otherwise specified arithmetic on the Model 100 is double precision with values ranging from 10^{-64} to 10^{+62} and 14 significant digits. Single precision (six significant digits) and integer arithmetic can also be specified.

Word processing with the Model 100

The text editor built into the Model 100 is one of the machine's best features. While 40 columns by eight lines of text may seem to be a limited display, in practice it works quite well on a paragraph by paragraph basis while the cursor control keys allow speedy access to other parts of a large document. Normally the cursor control keys move one character space at a time, but can be used in conjunction with the SHIFT keys to move word by word and to the top or bottom of a particular screen of text or with the Control key to move to the beginning or end of a line, or vertically to the beginning or end of an entire file.

The Backspace key by itself will delete the character to the left of the cursor and DEL (Shift-BKSP) deletes the character under the cursor. All keys (including the cursor controls) automatically repeat after being held down for a fraction of a second.

Large alterations of text are assisted by the "cut and paste" features of the editor. To move a section of text from one location to another, for example, the procedure is to mark the start of the text with the SELECT key (F7) and then move the cursor to the end of the passage to be selected. Text between the selected start and the cursor position is displayed in inverse to verify the operation. After a section of text has been marked it can be copied (F5) or transferred (F6) into a "paste buffer" and reinserted in the text at any location by moving the cursor and pressing the function key labelled "PASTE". The difference between a copy and a transfer (called CUT in the manual) is that COPY leaves the original text undisturbed while CUT deletes the originally selected text from the document. Text from the paste buffer can be used repeatedly throughout a document until it is over-written by a subsequent CUT or COPY operation.

Also available is the FIND command, activated by pressing F1, which prompts for a text string and searches the file for each occurrence of that group of characters. As with all function and cursor control keys the operation can also be initiated with a Control-key combination, a useful feature when the Model 100 is connected to a larger system. Control keys also activate some additional functions, allowing the insertion of printer command codes in text (Control-P) and the addition of a carriage return/linefeed to text lines (Control-M).

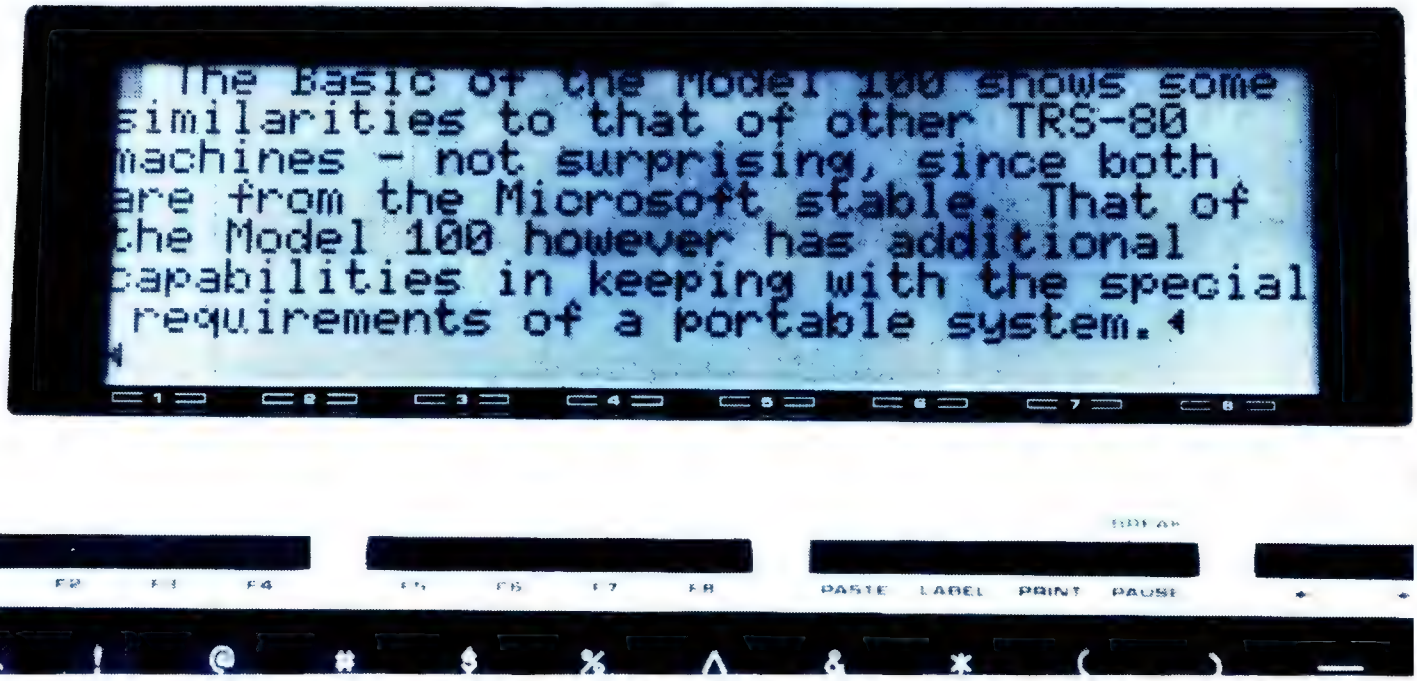
Limited print formats

The one limitation of the Model 100 text editor is the narrow range of print formatting commands. One function key, labelled PRINT, serves either to print the contents of the screen on a parallel printer or (used with SHIFT) prints the entire file. Screens are printed exactly as they appear, in eight lines of 40 characters each while SHIFT/PRINT first prompts for a line length and formats the text accordingly. There is no way of printing part of a file which crosses two screens – printing is all or nothing.

Text files can however take advantage of I/O redirection and can be saved and loaded from RAM or a cassette recorder or sent via the RS232C port to a larger system, using either a modem or a direct serial link. Once transferred to a large computer the full range of print formatting commands of that system could of course be used on the file.

Since Model 100 Basic can also read and write data files it would also be possible to create text formatting programs in Basic and overcome the limitations of this aspect of TEXT.

The 40 character by 8 line LCD screen displays large, clearly readable upper and lower case characters.



As well as word processing and program editing, TEXT must be used to create ADRS.DO and NOTE.DO files required by the address list and scheduling programs.

Using the address filing program (called ADDRSS) requires the creation of a data file with the name ADRS.DO with the text editor. Once the file is created it can be searched with the commands Find and Lfnd (F1 and F5). Find searches the entire file for a match to the string specified and displays the result.

ADDRSS is a rudimentary program. The data file is searched from the position of the cursor to the end of the file in its entirety rather than field by field, so that for example, "Mr Jones" and "Jones Street" both match the string "Jones". Capitalisation does not seem to matter – "smith" and "SMITH" are reported as matching strings – but this is unimportant in this application.

The SCHEDL program works in exactly the same way as the address organiser, using a file called NOTE-DO and the command Find and Lfnd to search for a specified string. In spite of the name the program does not take advantage of the clock/calendar feature of the Model 100 and while useful as a general-purpose filing program will be disappointing to those expecting an appointments manager or reminders of important dates. Any competent programmer could do a better job, given the power and features of the system and no doubt many will.

Communications

The Model 100 communications program, TELCOM is both versatile and easy to use. TELCOM is entered from the menu and operates in one of two modes; an "entry" level which allows communications parameters to be specified, and the terminal mode itself, activated by pressing F4.

The entry mode allows the selection of data transmission rate (nine standard baud rates from 75 to 19,200bps), word length (6, 7 or 8 bits), parity, number of stop bits and handshaking status. The default mode is 300 baud, 7 bits, no parity and one stop bit, as used by the majority of bulletin boards and dial-up services.

In the terminal mode operations are selected by pressing various function keys. Full or half-duplex operation can be selected and data displayed as it is received or stored in a RAM file for later use. Optionally, incoming data can be echoed to a parallel printer, and files can also be transferred to the host system. Some users of this feature have reported problems caused by the fact that the Model 100 does not transmit a line feed character with a carriage return. Many bulletin boards expect each line of data to be terminated by a line feed/carriage return pair, and special formatting programs would be required to use the Model 100 successfully with such services.

This difficulty aside, TELCOM makes the Model 100 a simple, compact terminal for communication via a modem or an RS232C link. Apart from use as a portable computer terminal the communications capability also makes the machine ideal for transferring data between otherwise incompatible systems and other users have discovered the advantage of entering data in the field and later transferring it to a larger computer for storage, formatting, and printing.

In conclusion

Who will use the Model 100? First of all, it must be said that for mathematical calculations and other applications where the large text display and full-sized keyboard is not required the Sharp PC-1500 or similar Tandy pocket computers are quite sufficient. Using the Model 100 solely for these applications would represent "overkill".

Where the Model 100 really shines is in text processing and communications. The full keyboard, 40 character by eight line display and integrated software really come into their own here, while the availability of a terminal mode makes the Model 100 an ideal mobile adjunct to a larger computer system.

At the moment however the features of the Model 100 are under-utilised by the existing software. The TIME and DATE functions could be put to much more extensive use and print formatting is limited, but in spite of this the Model 100 may be the wave of the future. Programs from Tandy and independent software suppliers will become available as the Model 100 comes into wider use but already the potential is evident. Tandy has gone a long way towards translating the writer's dream into reality.

Prices and expansion

Compared to "pocket computers" the Model 100 is an expensive machine. Considering the wealth of features though, and comparing the price with portables such as the Epson HX-20 and the NEC PC-8201 gives a truer perspective on the price. A Model 100 portable computer with 8K of RAM costs $1099. Memory expansion is relatively expensive at $169.95 per additional 8K of RAM, but a second version with 24K of RAM already installed is priced at $1399. Adding the memory to bring the Model 100 up to its full 32K means that the machine reviewed here costs $1568.95. A parallel printer cable to suit costs $24.95.

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Jaycar & Electronic Agencies

"Blueprint" 5000 preamp

Cat. KE4202

FUNCTIONS
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- MOVING MAGNET (DYNAMIC CART)
- INPUTS (2 OFF)
- TUNER INPUT
- AUX INPUTS (2 OFF)
- TAPE INPUTS (2 OFF)
- INPUT LEVEL CONTROL
- TAPE OUTPUTS (2 OFF)
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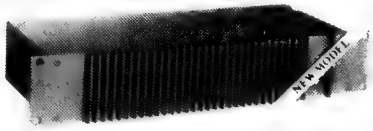

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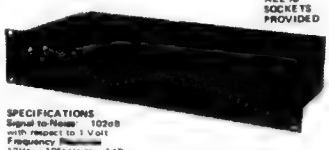

SPECIFICATIONS
Signal to Noise: 102dB with respect to 1 Volt
Frequency Response: 12Hz 105kHz to -1dB
Boost/Cut 14dB (28dB total)
Distortion 100Hz 0.007% 1kHz 0.007% 10kHz 0.008% (essentially irrespective of cut or boost)
Current consumption (DC) Approx 100mA @ ±15V (Requires 30V AC CT)
Output short-circuit proof

AUSTRALIAN (NOT HONG KONG) MADE - SPECIAL BUILT RACK CABINET - QUALITY!!!

Cat. KE4204

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Ref. EA March 1983 (This month)
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All parts are included to complete the meter including an attractive and colourful front panel (a 9V battery is required).

Set of test probes to suit $2.95
Probe to suit Cat. WT5312 ONLY $2.50
Eveready 216 (red) 9V Battery Cat. SB2370 ONLY $1.40

"LEARN ELECTRONICS AND END UP WITH A USEFUL PIECE OF TEST GEAR IN THE END"

DP2010 kit Cat. KJ7010 ONLY $45

SPECIFICATIONS

Function	f.s.d	Resolution	Accuracy	Protection
Volts (d.c)	2V	1mV	1% ±1 digit	500V for
	20V	10mV	1% ±1 digit	one minute
	200V	100mV	1% ±1 digit	
	500V	1V	1% ±1 digit	
Current (d.c.)	2mA	1uA	1% ±1 digit	1A/250V
	20mA	10uA	1% ±1 digit	
	200mA	100uA	3% ±1 digit	
	2000mA	1mA	5% ±1 digit	
Volts (a.c.)	2V	1mV	2% ±5 digit	500V for
	20V	10mV	2% ±5 digit	one minute
	200V	100mV	2% ±5 digit	
	500V	1V	2% ±5 digit	
Current (a.c)	2mA	1uA	2% ±5 digit	1A/250V
	20mA	10uA	2% ±5 digit	
	200mA	100uA	4% ±5 digit	
	2000mA	1mA	7% ±5 digit	
Resistance	2K	1	1% ±1 digit	260V
	20K	10	1% ±1 digit	r.m.s
	200K	100	1% ±1 digit	
	2000K	1K	1% ±1 digit	
Diode Test	2V	1mV	1% ±1 digit	260V r.m.s

AC VOLTAGE AND CURRENT RANGES
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FREE! Quality IC sockets provided in both kits.

REF: EA 11/81-1/82

7 OCTAVE (88 NOTE) VERSION $589

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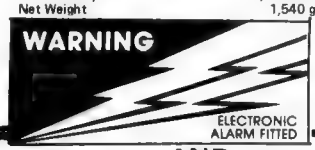
Flux Density	8,300 Gauss
Net Weight	1,540 gm



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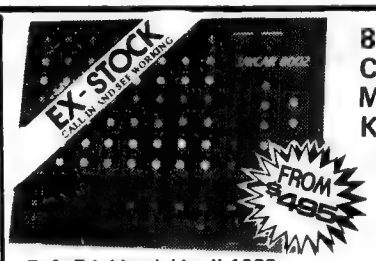

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Making PCBs in small

Making printed circuit boards for your own designs or for projects described in this and other magazines can be very satisfying. With new techniques and products the process is simple, clean and efficient.

There are a number of methods available to the constructor who wishes to make his own printed circuit boards (PCBs) but this article will focus on the methods used at Electronics Australia to produce project prototypes. Except for the scale of production the techniques involved are essentially the same as those used in commercial electronics manufacture, using photographic processes.

Although the materials described here cost more than etch-resistant inks and paints, the higher cost can be justified by the advantages of the dry resist process. Artwork processed as a photographic film can be used repeatedly, producing consistent results with a minimum of mess and fuss. No special skills are required once the initial PCB pattern has been created, making the method ideal for small manufacturers and hobbyists.

After the design of a circuit has been finalised the first step in making a printed circuit board is to create the artwork representing the PCB pattern. For this purpose we use actual size adhesive tapes and IC pads, such as those made by Bishop Graphics and the Japanese Izumiya company. These are rubbed down in the required pattern on a sheet of transparent plastic to produce a positive image, with areas of copper represented by tapes over the clear plastic.

The next step is to transfer the circuit board image to film to create a permanent copy of the artwork. Artwork created with tapes and adhesive materials are not suitable for multiple use or permanent storage as the tapes tend to come adrift in time.

To create a film copy of the artwork, UV sensitive photographic material is used. When the taped copy is clamped together with a suitably-sized piece of 3M Reversal Film type 8007 and exposed to ultraviolet light a negative image is created, with areas of copper represented by clear film and areas of opaque film representing those parts which must be etched clear of copper.

In researching this article we used a UV light box from Kalex. This professionally produced box uses four UV tubes and is fitted with a slide-out drawer and shelving to permit exposures to be made on one of two levels to cater for the different properties of photosensitive films, copper-clad board and 3M "Scotchcal" materials.

An exposure time of 10 seconds is all that is required to transfer the artwork image to the sensitised film, although if in doubt it is best to over-expose rather than under-expose the material. Following developing in a chemical bath the film produces a high contrast negative ready for use in exposing a sensitised copper-clad board. Of course, before the image is developed, futher exposure to UV light can mar the image. For this reason the film must not be exposed to sunlight or fluorescent tubes, although a low-wattage incandescent lamp can be used in the work-room as dark-room conditions are not required. The black plastic bags used for shipping the sensitised films are ideal for temporary storage and transport of films between exposure and developing.

Once transferred to film the artwork can be usd to create as many printed circuit boards as are required. A special type of copper-clad board coated with UV light-sensitive etch resist is used here. Called "Riston" (trade name) board, this material is exposed to ultra-violet light through the negative produced in the previous stage. Again the Kalex light box can be used, although the optimum exposure time for the Riston board is slightly longer at around 90 seconds.

When treated with the developer, areas of the resist exposed to ultraviolet harden and become impervious to the effects of the etching chemicals while unexposed areas are not affected.

As supplied the Riston board is covered by a protective plastic film which should be left in place during exposure and removed before the board is developed. For best results the board should be left for around 15 minutes between exposure and developing to allow the chemical coating to stabilise.

A pool of developer sufficient to cover the board is all that is required (say about a dessertspoonful for an average board), although additional developer can be added during the process. Kalex supply their own brand, either in a concentrate ready-to-use 25% solution.

When developed the copper areas of the board take on a dark blue colour. This is the etch resist which will prevent these areas from being affected by the etchant solution. A properly exposed and developed board should have copper areas which are hard and resistant to scratches. If the exposed area is soft it is most likely that the exposure time was insufficient and there will be a loss of definition in the finished board. Over-exposure, on the other hand, will enlarge the PCB tracks and close up small hole patterns, leading to problems when the board is etched.

After treatment in the developer bath the board should be washed in running water to remove all traces of the developer. Etching is the next step. Any of the commonly available etchants can be used, including ferric chloride or ammonium persulphate, can be used here. Both are poisonous and corrosive, and in addition ferric chloride will discolour fabrics and other materials it contacts.

Etchants are usually sold in powder form and mixed as required. Plastic containers should be used for etching as the chemicals will attack metal. Between uses all solutions should be stored in clearly labelled bottles. Warming the solution or mixing the powder with hot water will reduce the etching time.

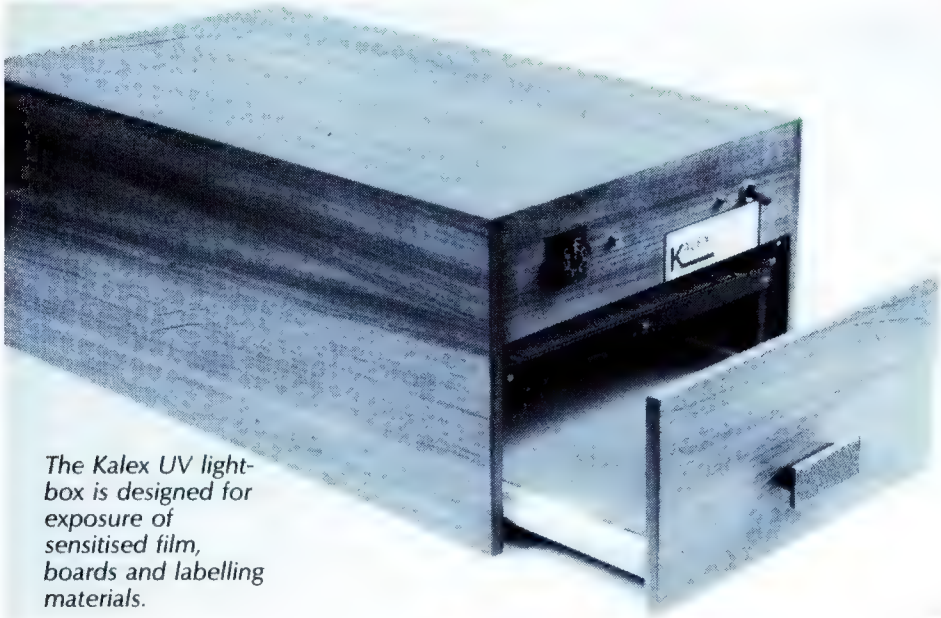
Commercially available etching tanks use racks to hold the boards and a pump to circulate the etchant to reduce the time taken for the etching process. Kalex make two models, one a full-featured version for mass production and the other a simple two-compartment tray with supports for PCBs. Vertical mounting in this model restricts the size of PCBs to approximately 15cm ×9.5cm, although boards up to 19cm square can be etched if they are laid flat in the tank.

For home and hobbyist use a plastic tray is perfectly adequate as long as it is sufficiently large to allow the full immersion of the required board.

After etching the board should be washed in clear running water to remove all traces of the etching solution and the hardened etch-resist removed with steel wool and methylated spirits. Once the bare copper is exposed the board can be trimmed to size and drilled, ready to form the basis of an electronic masterpiece!

quantities

by PETER VERNON



The Kalex UV light-box is designed for exposure of sensitised film, boards and labelling materials.

The Kalex UV light box

The Kalex UV light-box is intended for use in the commercial application of the PCB techniques described in the accompanying article. It has been designed to process 3M Scotchcal, 3M I.N.T. labelling materials, 3M exposure film and Riston 3000 boards.

Four Philips T1 03T UV tubes with a peak wavelength of 420 nanometres are built into the top of the box for this purpose, although the box can also be used in other applications where UV light exposure is required by fitting tubes which peak at lower wavelengths if necessary. An "instant start" feature ensures that the tubes come on immediately, without flickering, as Kalex have eliminated the starters and provided transformers to preheat the tube filaments.

The light box measures 42.8 × 78.8 × 29cm (W × D × H) and is finished in wood grain veneer. The artwork or PCB to be exposed is placed in a drawer which slides in and out of the box and held in place by a plate of glass on a foam rubber backing surface. Materials with dimensions of up to 55 by 26cm fit comfortably in the box.

Two intensities of exposure are available since the sliding drawer can be fitted on one of two levels created by internal shelving in the box. The upper level places the artwork about 10cm from the UV tubes, but requires the sliding drawer to be fully removed from the box and turned upside down before re-installation. Both sides of the bottom surface carry foam backing, but the removable glass sheet must be re-located, a process that would be simplified if it was fitted with some sort of lifting handle.

On the front panel of the drawer is a dial for setting the mechanical exposure timer, a toggle switch controlling power to the tube filaments and two indicator lights; "power on" and "exposure in progress". Mains power is controlled by the switch on the wall socket as there is no mains power switch on the light box. A microswitch in the cabinet ensures that the UV lights cannot be switched on with the drawer open.

The timer is a mechanical type with the dial marked with numbers from 0 to 6 and graduated in tenths. A separate timming control sets the overall range of the timer from one of three ranges; 0-3.6 seconds, 3-60 seconds and 36-720 seconds. A small screw-driver is needed to make this adjustment, although we found that once set on the 60 second range further adjustment was not required when exposing UV sensitive films. With the tray on the lower level however, from one to two minutes is required to correctly expose Riston copper clad board, making the 12 minute range necessary.

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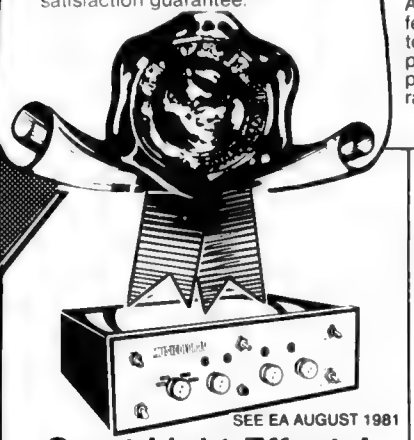

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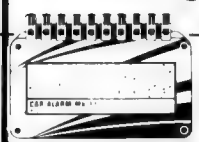

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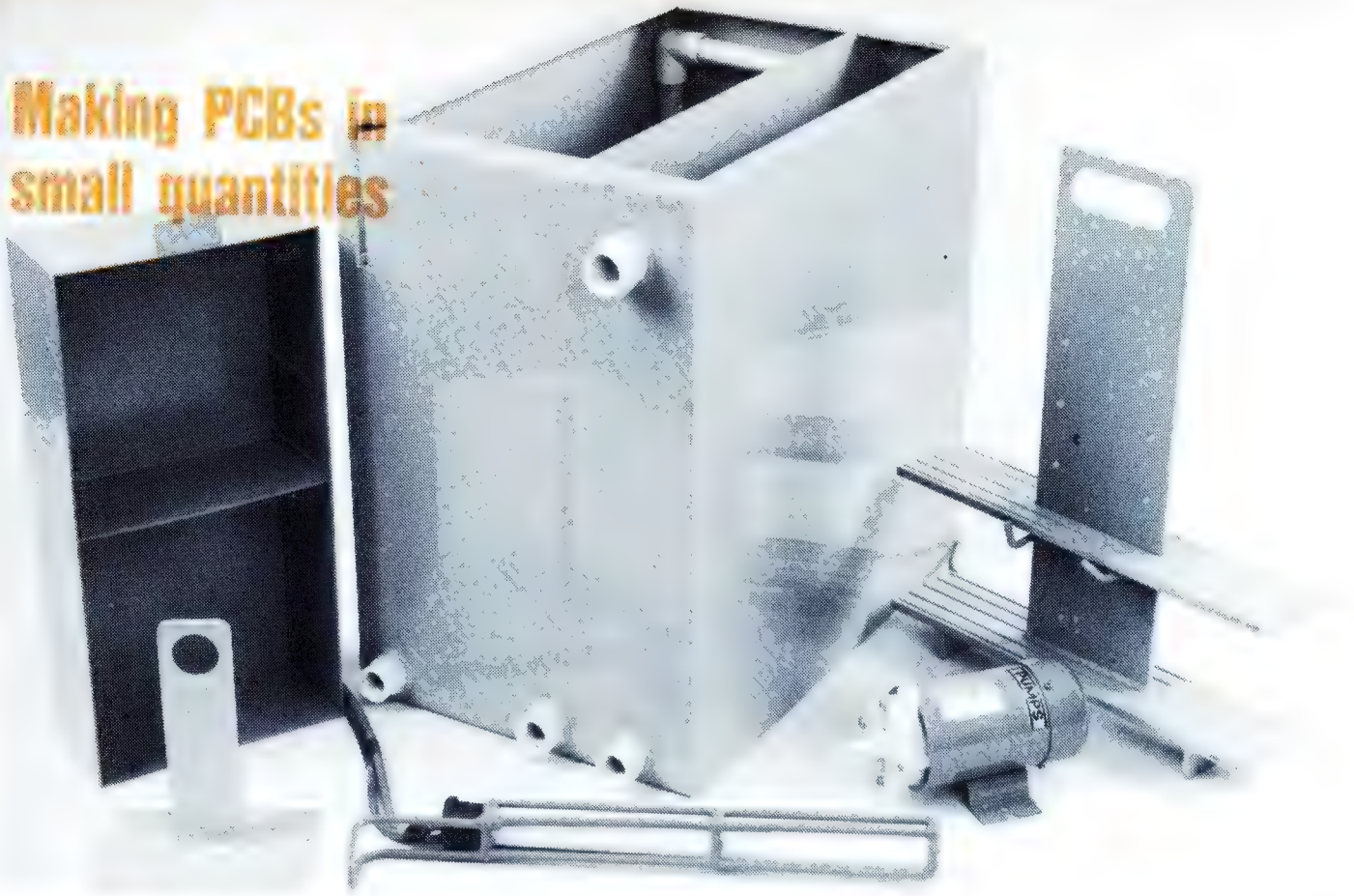
DICK SMITH Electronics

See page 120 for full address details.

Making PCBs in small quantities



This etching tank includes mounting racks, a heater and pump circulation of etching fluid.

The box is 100% light-proof when the sliding drawer is closed but the mechanical timer and exposure indicator light provide confirmation that the light box is in operation. Once the selected exposure time is set on the timer dial, closing the drawer activates the microswitch and turns the lights on for the set period. Opening the box or switching off the power to the tube filaments instantly turns off the lights and sets the timer back to the start of the specified period, ready to be activated again when the drawer is closed.

This arrangement is ideal for exposure of multiple boards or artwork, as the timer need only be set once, at the start of the process. It also means, however, that when the box is first switched on the timer comes up with whatever setting was last used.

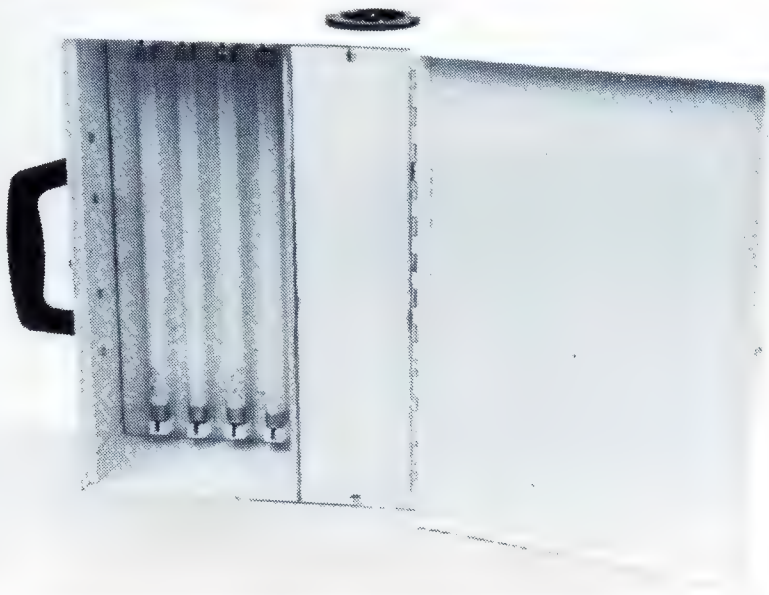
Kalex also make a smaller light box, the "Portu-vee", designed to the same high standard and suitable for exposure of materials with dimensions of up to 25 × 18cm. Unlike the larger unit this is a fully portable device, somewhat similar to a suit-case with four UV tubes mounted in the lid and a carrying handle on one side.

A commercial etching tank is also available, fitted with a 10W magnetic pump to circulate the etchant or developer. The pump is mounted externally and pumps through two tubes mounted vertically at diagonally opposite corners of the tank. The tubes are drilled to produce a series of jets in the liquid, augmented by liquid circulation to the pump input across the bottom of the tank.

A heater is mounted at the same corner as the tank outlet where suction from the pump prevents the warmer solution from rising to the top of the tank, ensuring a more uniform bath temperature. Racks for mounting printed circuit boards are also included, and the tank is compartmentalised to allow etched or developed boards to be rinsed by the circulation of fresh water through a hose connection from the water supply. An outlet hose allows waste water to be channelled away from the work in progress.

Kalex can also supply a full range of 3M and Riston materials, developers and etchants and all requirements for manufacturers and hobbyists wishing to produce their own professional standard PCBs. For further information contact the company at 101 Burgundy St, Heidelberg, 3084 or their branches in Yarraville and Melton, Victoria. Phone (03) 458 2976.

The Kalex "Portu-vee" light box is suitable for smaller jobs and is fully portable.



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Specifications:

PROCESSOR: Z80A running at 3.375 MHZ

KEYBOARD: 60 key FULL SIZED QWERTY layout with full travel.

MEMORY: 44K comprising of 16K user RAM (expandable on-board to 32K), 20K ROM software, 4K character ROM, 4K graphics and screen memory.

DISPLAY: Direct video to external monitor or modified TV. 80 by 24 and 64 by 16 character display modes, high resolution PCG graphics to 512 by 256 pixels. Upper and lower case with full programmability at any screen location.

SOFTWARE: MICROWORLD 16K BASIC V5.22 in ROM, MICROWORLD Z80 machine code monitor, built-in diagnostics, NETWORKING with programmable baud rates from 110 to 4800 Baud, 7,8 bit formats, half, full duplex transmission and complete file transfer using the 'HOBBY' standard Christensen protocol.

INPUT/OUTPUT: Programmable 8 bit input/output parallel port, programmable RS232 port, cassette interface, direct video, 50 way Z80 expansion bus.

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The **microbee Series 2** was specifically designed to serve the needs of the EDUCATION MARKET. Let's face it, the primary non-business use for most personal microcomputers is to increase our learning capabilities either about computers (computer awareness) or about life itself. **microbee Series 2** has now been officially approved by Education Departments in NSW, WA and Queensland and is being carefully considered in virtually all other states and by the National Schools Commission at the time this magazine was going to press. Over 5,000 **microbees** are now in constant use in schools, universities and technical colleges throughout Australia and New Zealand and the number is growing daily.

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KEYBOARD: 60 key FULL SIZED QWERTY layout with full travel.

MEMORY: 36K comprising of 8K user RAM (expandable on-board to 16K), 20K ROM software, 4K character ROM, 4K graphics and screen memory.

DISPLAY: Direct video to external monitor or modified TV. 80 by 24 and 64 by 16 character display modes, high resolution PCG graphics to 512 by 256 pixels. Upper and lower case with full programmability at any screen location.

SOFTWARE: MICROWORLD 16K BASIC V5.22 in ROM, MICROWORLD Z80 machine code monitor, built-in diagnostics, NETWORKING with programmable baud rates from 110 to 4800 Baud, 7,8 bit formats, half, full duplex transmission and complete file transfer using the 'HOBBY' standard Christensen protocol.

INPUT/OUTPUT: Programmable 8 bit input/output parallel port, programmable RS232 port, cassette interface, direct video, 50 way Z80 expansion bus.

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By popular request, the low cost **microbee Series 2 Experimenter** has been designed for those who are starting out in the fascinating world of computers or those who want to share the fascination of exploring the exciting developments in the fast moving MICRO WORLD.

Demand for projects using the **microbee** is so great that 'Electronics Today' are now planning to run a **microbee** project every month during 1984. So far ETI has described the light pen, EPROM programmer, a radio TTY printer, the World's first home facsimile receiver and ROM expander board for the **microbee**. Virtually every local computer magazine has run reviews and/or columns devoted entirely to the **microbee**. If you want to be part of the MICRO-COMPUTER GENERATION in 1984 then **microbee Series 2 Experimenter** is the ideal starting point.

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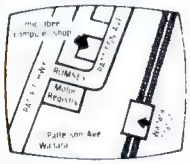

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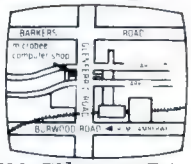

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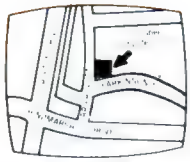

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microbee

New Products...

Product reviews, releases & services

Electric cleaner for soldering iron tips

C & K of Australia has recently acquired the Australian agency for Elvo Electronics Ltd of Switzerland. Included in this new range is the Elvo soldering iron tip cleaning instrument, the "Clean-o-point", a self-contained unit which uses motor driven sponge rollers to provide fast and reliable tip cleaning on the production line or work bench.

Features of the Clean-o-point include a quick, positive cleaning action and the provision of a removable tray which collects excess solder – which can be recycled. In a manufacturing plant the elimination of this wastage plus the extension of life of soldering iron tips made possible by regular cleaning can pay for the cost of the cleaning unit in a very short time.

For further information contact C & K Australia Pty Ltd, 15 Cowper St, Parramatta, or PO Box 229, Parramatta, 2150. Phone (02) 635 0799.

Warburton-Franki data on PLAs

Warburton Franki now has available a 32-page guide book which explains programmable logic arrays and the advantages offered over fixed function LSI and custom circuits.

Published by Data I/O, the book describes an actual design problem, showing how design equations were generated and translated into fuse tables to program the logic arrays. Functional testing is also covered.

The book, "Programmable Logic – A Basic Guide for the Designer" is available free of charge from your local Warburton Franki office or the head office at 199 Parramatta Rd, Auburn, NSW, 2144.

Discolighting for the home

New from Arlec Pty Ltd is "The Discolite System", described as "a complete portable lighting set for your very own disco effects at home".

The set consists of six lamps and holders, cable, two reflectors with brackets and the Discolite control unit. Assembly requires no wire cutting or joining, so the complete system can be set up or dismantled in minutes.

The six coloured lamps have a mirror coating on the inside of the globe to concentrate the light output while the reflector units are free-standing but with provision for fixing to walls and ceilings etc.

Rated at 500W and connected directly to any 240V mains outlet, the Discolite control unit functions either to flash the lights in time with music, as a strobe light controller, or a light dimmer. In the music mode an internal microphone picks up the beat of the music to allow control of the lights without direct connection to audio equipment.

In the strobe mode, the Discolite will flash the lights at a selected rate independently of the sound source. In the "Dim" mode the Discolite becomes a light dimmer, allowing continuously variable adjustment of light intensity.

Arlec products are available from their dealers throughout Australia, including their new agencies in Canberra, [24 Geelong Street, Fyshwick, ACT (062) 805 519] and Wagga [7 Norton St, Wagga Wagga, NSW, 2650 (069) 212 735].

Arlec Pty Ltd also has outlets in Victoria, 30-32 Lexton Rd Box Hill; NSW, 47 Drummond St, Belmore; Queensland, Cnr Vernon Terrace and Ethel St, Newstead; South Australia, 30 Beulah Rd, Norwood; and Western Australia, 611 Hay St, Jolimont, 6014.

Video tapes on electronic tools and techniques

Educational Video Productions, of Melbourne, has available a series of four instructional video tapes covering tools and techniques for electronic assembly, PCB production and soldering.

The tapes are intended for use in schools, TAFE colleges, technical institutions and industrial training programs, and are the result of extensive research by educationalists and industry engineers from leading Australian companies.

The four titles – the first of the series – are "PCB Artwork Design", "PCB Fabrication", "PCB Assembly – Tools" and "Soldering". The third title is actually a double presentation, the first on component mounting, handling and board assembly and the second on tools for electronic work, including a review of the Xcelite range of tool kits.

Tools are divided into "essential" and "optional" categories and the selection criteria for each type explained along with illustrations of their use.

Each tape concludes with a series of multiple choice questions designed to reinforce the material presented and each provides a very good introduction to the topics at a high school level.

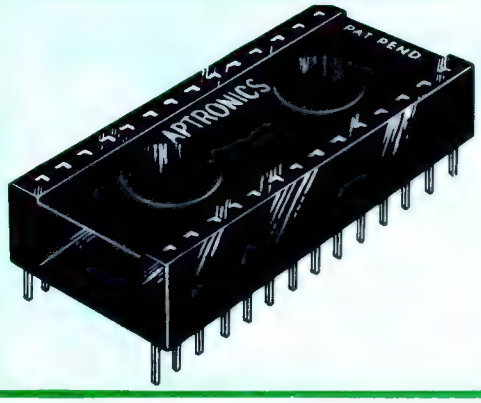
Running time of the tapes varies, but the tape on soldering techniques, for example, is 22 minutes long. Topics include the reasons for soldering, solder composition and the role of flux, the varieties of soldering irons available and handling precautions for sensitive components. Continuous heat and variable temperature irons are described and illustrated with explanations of the advantages and disadvantages of each type and the various defects of soldered joints are detailed. Multiple choice questions conclude the tape.

The tape on artwork design runs for 20 minutes and is a complete explanation of the steps from a circuit diagram to the production of a PCB artwork master, presented in a simple, understandable way. It in turn leads into "PCB Fabrication", which covers the making of artwork negatives, the use of photo-resists, board exposure and etching, concentrating on the use of Riston materials. Again a series of questions at the end of the presentation reinforces the material and adds to the usefullness of the tapes for teachers in a classroom situation.

We have viewed the tapes and were impressed by the clear presentation and quality production standards. According to EVP, professional studio facilities, presenters and directors have been used throughout, and the final production reflects this attention.

The original material has been produced on one inch master tapes to broadcast specifications and are individually duplicated onto video cassette for distribution. Both Beta and VHS formats are available.

With the increasing emphasis placed on electronics and contruction techniques, particularly in the TAFE curriculum and secondary schools, the EVP tapes should play a valuable role. They are available at $39.95 (plus sales tax where applicable) from Educational Video Productions, 57 Burwood Rd, Hawthorn, Vic, 3122. Phone (03) 819 4983 (10am-4pm only).



"Programmable" IC sockets simplify prototypes

Rifa Pty Ltd has announced the release of a new "programmable" IC socket that allows the pins of integrated circuits to be selectively connected to different pins of the socket.

The main application is seen as matching different IC pin-outs to existing circuit board layouts, a need which occasionally arises when using devices from a number of different manufacturers.

Installation of the socket allows all sources of a particular IC to be used regardless of pin configuration, facilitates evaluation of new devices and speeds up-grading and testing in the field.

For further information on the new socket contact Rifa Pty Ltd, 202 Bell St, Preston, Vic, 3072. Phone (03) 480 1211.

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MICRON SUPER 80

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BIT IMAGE GRAPHICS
FRICTION FEED AND
ADJUSTABLE SPROCKET FEED

MADE IN JAPAN QUALITY

A FEATURE PACKED DOT MATRIX PRINTER FOR UNDER $500

Your "Super 80" printer will enable you to print **letters, reports, graphics generated pictures,** etc and importantly for the programmer, Hard Copy of **program listings.**
Operating under software control from any general purpose micro-computer the Super 80 features **13 different print types** including emphasized (LETTER QUALITY) **Bidirectional print action** ensures **smooth, quiet operation.**

128 ASCII Characters, Handles 4" to 10" Paper
STANDARD CENTRONICS INTERFACE

VALUE PACKED AT D1174..... **$499.50**
INTERFACE CABLE TO SUIT MICROBEE D1190..... **$45.00**
SPARE RIBBON D1175..... **$12.50**

DC PLUG PACKS

AT LAST . . . DIRECT IMPORT PRICES ON FULLY APPROVED PLUG PACKS

Great for powering small Micro's, TV Games, Slot Car Sets, etc.

Eliminate the need for batteries, when testing or operating new projects.

M9000
240v AC — 3, 4.5, 6, 7.5, 9, 12v DC @ 300mA
ONLY..... **$14.95**
4 OR MORE..... $13.50

M9005
240v AC — 6, 9, 12v DC @ 500mA
ONLY..... **$14.95**
4 OR MORE..... $13.50

Both Plug packs come with instructions and a 4 way multiplug 1.6m lead.

INSULATED TO ASC 126

CENTRONICS PLUG
36 WAY
D1192
$14.95

When you buy one of our printers you'll need a centronics plug. If you are **MICROBEE USER,** have a look at our **INTERFACE KITS** on the opposing page.

UK MADE, GOLD PLATED
D RANGE CONNECTORS
SAVE 25% ON BULK QUANTITIES!

			ea.	10 +	25 +
P 0880	DB9	Male 9 Pin	2.50	2.30	1.85
P 0881	DB9	Female 9 Pin	2.95	2.70	2.50
P 0885	DB9	Backshell	2.85	2.50	2.50
P 0890	DB15	Male 15 Pin	2.95	2.50	2.29
P 0891	DB15	Female 15 Pin	3.50	3.00	2.80
P 0895	DB15	Backshell	2.85	2.50	2.50
P 0900	DB25	Male 25 Pin	4.50	3.95	3.60
P 0901	DB25	Female 25 Pin	4.95	4.50	3.98
P 0905	DB25	Backshell	2.85	2.50	2.50

THE SENSATIONAL MICROBEE IC

SCREEN FORMAT 64 x 16 OR 80 x 24 WHILE NETWORKING EG. USED AS A TERMINAL

The all new Microbee IC has got to be the most value packed ROM based personal computer available today. **New enhanced basic** enables 64 x 16 or 80 x 24 screen format while networking and the clock speed is now **a zippy 3.375 MHZ** and over **$110** worth of software integrated in ROM i.e. the absolutely delightful **Wordbee** word processor package or **Editor Assembler** plus all the other exciting features that have made the Microbee famous

D1020..... 16K IC..... **$499.00**
D1035..... 32K IC..... **$599.00**

ARCADE GAMES, PERSONAL, BUSINESS AND EDUCATIONAL APPLICATIONS.

SOFTWARE

JUST PHONE OR WRITE & ASK
WE'LL SEND YOU OUR SOFTWARE CATALOGUE
HONEYSOFT • MYTEK • DREAMCARDS

• FOR DESPATCH P&P CHARGES AND ADDRESS DETAILS PLEASE REFER TO OUR AD. ON PAGE 149 •

A SINGLE BOARD CP/M COMPUTER

"THE LITTLE BIG BOARD"

64K on board RAM, Z80A based running at 4mHz (Top speed) Floppy disk controller, Real time clock.

That's right! A fully configured Z80 computer running at maximum capacity on a single **PCB. On board disk controller** drives up to four double sided double density drives either 8" or 5¼". **2 by RS232 I/O Ports,** both may be software configured use one for a terminal the other for a printer or modem etc **Battery backed real time clock** software accessible for automatic dating of documents timing during games Fully **STD buss compatible** — choose from thousands of ready available plug in card options **Bootstrap Monitor** on board — boots to **CP/M.** Choose from the world's **largest range of software.**

ALTRONIC KIT FEATURES

Two versions of the bootstrap monitor supplied One set **for 1200 baud operation** enables connection to **MICROBEE 16 & 32K IC'S** utilizing their terminal emulation facilities The other set for **9600 baud** operation
Complete set of **IC** sockets
Double sided plated through **PCB** — solder masked and prefinned
56 Pin **STD** connector
2 x DB25P's and ribbon cable for peripheral connections
Quality components used throughout including solder and full documentation

K9690
$499

CP/M Diskettes

8" 9600 Baud
K9691 **$150**
5¼" 9600 Baud
K9693 **$150**
8" 1200 Baud
K9692 **$150**
5¼" 1200 Baud
K9694 **$150**

COMPUMUSE

YOUR GAMES WILL NEVER BE THE SAME

A computer music synthesizer that is **easy to build** and **easy to use,** connects to any computer with a Centronics-style parallel port and provdes music over a five octave range and a wide variety of sound effects.

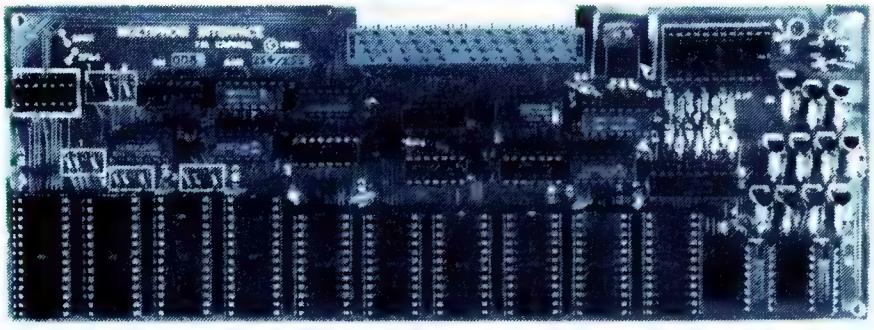
★ EXPERIMENTAL KIT - PCB, COMPONENTS & SOFTWARE.

K9834..... **$26.50**

MULTIPROM INTERFACE FOR THE MICROBEE

(ETI NOV. '83)

44K OF PROGRAM STORAGE ★ FULLY SOFTWARE SELECTABLE ★ SUITS BOTH IC AND PLUS MACHINES ★ 8 OUTPUTS FOR CONTROL APPLICATIONS ★



A sensational new kit for the MICROBEE, requires no modification to the computer except for the fitting of a 50 pin expansion socket. This project is easy to build and will allow you to store and software select up to 44K of eprom storage — acts like a mini disk drive system with the speed of RAM. Extra units may be added to further increase storage.

The Altronics Kit comes complete in every way
★ Full set of IC sockets.
★ Double sided, plated through board.
★ Assembled connection lead to Microbee.
★ Fully documented.
★ Cassette monitor included (plus sourcefile).

THE MICROBEE KIT OF 1983

K9673..... **$99.50**

PRICE BREAK-THROUGH

50 PIN EXPANSION SOCKETS

Right angle type to suit Microbee, floppy disk controllers etc.
Mounts on PCB and mates with IDC sockets.

D1196... **$8.50** EA...10 +... **$7.50**

PRINTER INTERFACE KITS FOR THE MICROBEE

PARALLEL TYPE

INCLUDES CENTRONICS PLUG AND CABLE

BUILD YOUR OWN INTERFACE AND SAVE $$$

A simple kit to build — takes about 20 minutes, save on the cost of a built interface and save the cost of a serial printer.

K9671..... **$29.95**

TTY TYPE

Teleprinters are cheap, so is this kit. If you've got an old Teleprinter this is for your.

K9672..... (Only)..... **$17.50**

★ KIT SUPPORT FOR THE MICROBEE ★

EPROM PROGRAMMER

(ETI JAN '83)

K9668..... **$55.00**

Versatile, low cost and easy to build. Plugs straight into the microbee I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 Eproms. Burn your games programmes and eliminate cassette loading time.

KIT FEATURES Sockets for all other IC's 1 x 2716 supplied — get started straight away Front Panel and Mains (SEC approved) transformer 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included) DB 15 Plug Complete to last nut and bolt

(See Review ETI AUGUST 1983)

RADIOTELETYPE DECODER

(ETI APRIL '83)

K9733..... **$19.50**

Display RTTY encoded messages on your Video Monitor Receive up to date weather information international News before the Papers all sorts of coded military info Simple circuit uses PLL techniques Single PCB Construction Kit includes DB15 Plug and backshell for connection to microbee Shielded pretinned PCB

NEW

MICROBEE LIGHT PEN

(ETI AUGUST '83)

PROVIDES DIRECT PERSONAL CONTACT WITH YOUR BEE!

K9649 **$19.95**

AT LAST — a light pen for the Bee This pen works in the low resolution graphics mode and connects directly to the I/O port • Complete kit including DB15 2m CORD • Fully documented with software example

FAX-DECODER

(ETI SEPT '83)

K9733..... **$24.50**

This project allows you to decode the signals of shortwave stations transmitting radio facsimile weather maps satellite pictures etc and then reproduce them on your dot matrix printer.

• Complete kit of parts includes DB15 Ribbon Cable
• SOFTWARE LISTING

New Products...

Combined multimeter/ oscilloscope from Kent Instruments

A new device from Kent Instruments (Australia) combines the functions of a digital multimeter, an oscilloscope and a transient recorder in one portable, battery-powered package.

Called the Metrawatt M2050 Digital Scope Multimeter, the instrument combines a 3½-digital multimeter and a liquid crystal oscilloscope display with a resolution of 128 × 64 points.

The digital multimeter section of the instrument has 32 ranges covering current, voltage and resistance, and AC measurements may be made as either average value or true RMS. The flat screen LCD oscilloscope provides a high contrast image and a range of 30 input levels and eight timebases. Trigger capabilities include internal and external sources and AUTO trigger with a continuously variable trigger level.

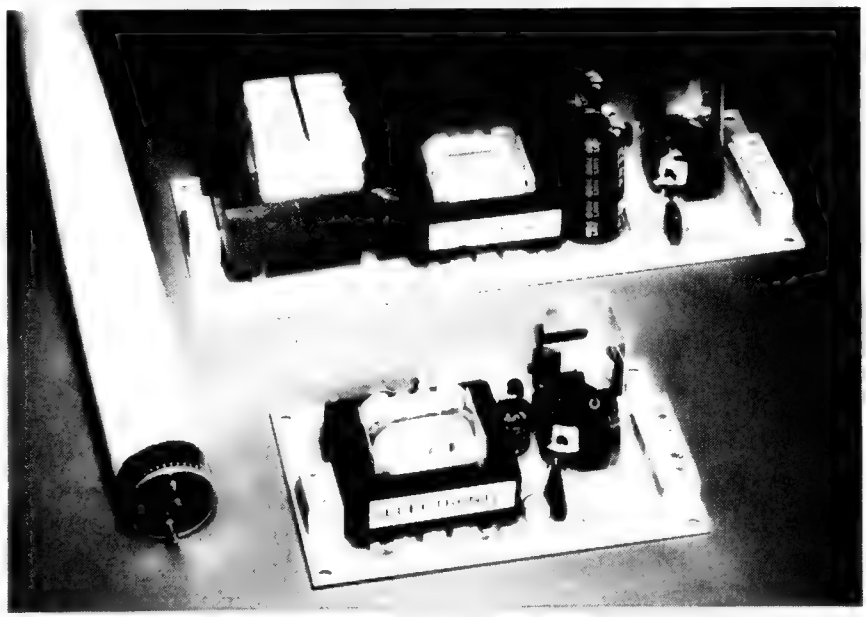
The digital oscilloscope section uses a successive approximation technique with a maximum sampling rate of 512kHz and a resolution of eight bits. Timebases for display of the full storage memory range from 1ms to 60 minutes and a ×4 expansion facility is available.

When configured as a transient recorder the M2050 uses two separate memories to store random transient events, with a maximum sampling rate of 500kHz. Once triggered by a transient event the recorder can display the memory contents on the LCD screen. The triggered position can be set to in steps of 25% from the start to the end of memory, allowing the user to view events before, at, or after the trigger event.

A chart recorder interface is also included to allow the stored waveform to be plotted. Signals to the plotter are interpolated to eliminate the effect of the sampling rate and produce smooth plots.

Measuring 257 × 169 × 88mm (W × D × H) when the display screen is folded down over the instrument panel, the M2050 will operate for up to eight hours from its internal Nicad batteries and retain data for approximately six months between uses. An AC adapter is also included for use when battery operation is not required.

For further information on the M2050 contact Kent Instruments (Australia) Pty Ltd, 70/78 Box Rd, Caringbah, NSW, 2229. Phone (02) 525 2811.



Selectronic's emergency lighting system

Selectronics has released details of new 8W and 10W emergency lighting systems for use in fluorescent fittings. The solid-state modules do not require a starter or ballast and are powered by three D-type Nicad cells.

The emergency lighting units are designed and manufactured by Selectronics, who claim that they are more than competitive with imported equipment.

Selectronics also manufacture a wide range of transformers and power supplies, including a new 350W five rail unit designed primarily for computer applications. The SM350AE1 is an open frame switch mode supply with five regulated outputs: +5.2V at 25A, +24V at 6A, +12V at 6A, −5V at 2A and −12V at 2A. Total output power is 350W continuous with a peak of 460W for 30 seconds.

Output ripple and noise is quoted as less than 2% p-p up to 20MHz and efficiency as greater than 65% at full load. Over-voltage protection is provided on the +5V, +12V and +24V rails and two 110V outputs are provided for powering cooling fans. Other features include reset and power fault signals, a remote on-off facility and remote selection of input voltage.

As with all power supplies from Selectronics the SM350AE1 is backed by a five year guarantee and complete technical back-up.

For further information, contact Selectronic Components Pty Ltd, 25 Holloway Drive, Bayswater, Vic, 3153. Phone (03) 762 4822.

AVTEK in the heart of "SILICON ALLEY"

MULTIPROM INTERFACE BOARD

MICROBEE

A NEW KIT

ONLY $99

The Multiprom board is an extension of the Microbees memory in ROM. It simply plugs into the fifty way bus expansion port on the core board. It fits either neatly inside the Microbee or behind it, using the Microbee's own power supply.

The board takes the EDASM and NET eprom normally residing inside the Microbee, but allows several different sets to fit in: Editor-Assembler, Wordbee, Logo, MiniPascal, Networkrom, Bemon or your own program. It has room for 4 sets of eproms in the EDASM location and 3 sets of eproms in the NET location, a total of 44K of eprom. The board can be simply daisy chained with up to 6 slave boards (using an outside power supply in this case), allowing a maximum total of 308K in ROM. The EDASM locations accept either type 2532 or 2764 eproms and they can be mixed. Another powerful feature of the board is the input output system. 11 outputs, open collector transistor driven. Each can turn ON or OFF a relay under program control. 8 inputs, buffered and protected can read 8 switch status ideal for computer controlling of model trains, alarm systems, tape recorders, machinery etc.
The Avtek kit includes a plated through board plus all components to make this exciting project. There is also provision on the board to change the address of the ports used for eprom selection and input output.

MULTI ROM BOARD

XM-1 – This is a totally new product developed EXCLUSIVELY for AVTEK. It takes two sets of EPROMs (e.g. WORDBEE and EDASM) and allows you to choose between them by simple KEYBOARD COMMANDS. It will take a short time to assemble and is simply installed inside the MICROBEE with one DIP plug (supplied) and two solder connections.
XM-1 suits early model MICROBEE plus models using 2532 type EPROMs.
These have serial numbers starting with 8 ONLY $19.95

XM-2 same as XM-1 but suits the "MICROBEE IC" and is even simpler to fit. Also responds to PAK1 and PAK2 commands.
These have serial number starting with 9 ONLY $16.95

bankcard

S-100 SOCKETS
High quality, gold plated
$6.95 ea or 10 for $65

LITTLE BIG BOARD

SEE ETI OCTOBER 1983 FOR FULL DETAILS
The Pukar Series 6000 microcomputer card has been designed to provide a cost-effective general purpose central processor that will find application in a wide range of systems, from stand-alone and dedicated control processors to multi-processing and network configurations. While the 6000 Series is fully compatible with the industry standard STD bus, attention was given to partitioning the circuit so that a complete disc-based computer system could be constructed using just one card. Included on the board is: Z80A processor operating at a full 4MHz, 64Kbytes dynamic RAM, single double density floppy disc controller, two RS232C serial I/O ports, 2Kbytes EPROM bootstrap monitor and battery-backed real-time clock and calendar.
Interfacing to the STD bus allows systems to include modules from a range of over 1800 cards available from some 80 manufacturers.

FROM $149

Card Includes:
- Power-on automatic bootstrap to CP/M system in on-board EPROM
- Real time clock chip with battery backed supply

Bus Interface
- All signals meet STD Bus electrical specs.

External Connections
- 50 way edge connector provided for 8" floppy disc connections
- 1 16 pin RS232C for terminal connection
- 1 16 pin RS232C for printer connection

FULL KIT PHONE FOR FINAL PRICE
PCB MANUAL & ROM ONLY $149.00

NEW STORE

172 LIVERPOOL ROAD, ENFIELD
Phone: (02) 745 2122

DON'T FORGET WE ARE PROBABLY THE LARGEST SELLER OF IC's, COMPONENTS, IDC CONNECTORS, ALTRONICS KITS ETC. IN SYDNEY

SLASHED

FAX 80

$399 INC. TAX!!

That's our price Dec Only
$10 P&P – NO Bankcard
Check the opposition!!

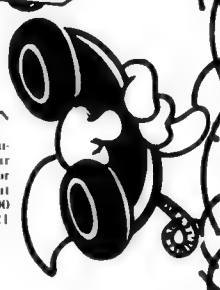
COMING SOON! Disc Controller & C/PM to suit 32K MicroBee – WATCH OUR ADS!!
CAR ALARM – WAS $69.50 SAVE $10 Dec. Only NOW $59.50 – full featured - easy to install.
Logic & Voltage testers SAVE nearly 20% $7.95 Dec. Only

"Reach the World" FOR AROUND $200

Multi Modem

Limited Stock

THIS KIT WILL KILL ALL OTHER KITS AVAILABLE IN IT'S TOTAL COMMUNICATION WITH THE WORLD READ ON
Modulation Frequency shift keying. Digital Interface RS-232C. Auto answer and disconnect. Data communication to basic Bell or CCITT specifications giving a world data communications capability. Operates with your normal phone. 300BPS or 1200 BPS with backward channel 75 BPS. Indicators and test switch. Auto answer or manual connect. Backward channel standard on 1200 BPS mode. Direct connection, inbuilt line isolation unit. Operates in the following modes: Bell 103 originate 300 BPS, Bell 103 answer 300 BPS, Bell 202 equalised 1200 BPS, Bell 202 1200 BPS, CCITT V23 mode 2 equalised 1200 BPS, CCITT V23 mode 2 1200 BPS, CCITT V21 originate 300 BPS and CCITT V21 answer 300 BPS.
AND IT'S COMING SOON!
THE PRICE AROUND $200 THAT'S HUNDREDS LESS THAN THE NEAREST EQUIVALENT!



AVTEK

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Divide the value of your order by 20 (5%) to get post and packing value and then add $2.00 it's that simple!
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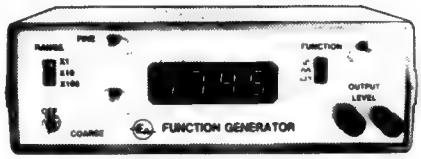
ALTRONICS DISTRIBUTOR ● FULLY EQUIPPED SERVICE CENTRE

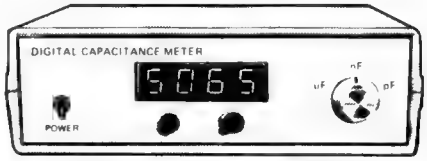
7 DIGIT FREQUENCY COUNTER

UNBELIEVABLE 0.005% ACCURACY

FUNCTION GENERATOR

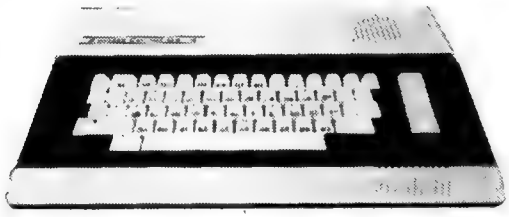


DIGITAL CAPACITANCE METER



with Deluxe Instrument Case

COLOUR GENIE



- 16K Rom — 16K Ram on board
- Expandable to 32K on board
- Extended microsoft basic
- RS232C & parallel ports built in
- RF & video built in
- Loads at 1200 baud
- 24 × 40 screen display
- Programmable characters
- 8 function keys

WIDE RANGE OF SOFTWARE AVAILABLE

$499 (incl. tax)

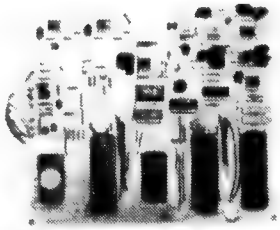
50V 5A LABORATORY POWER SUPPLY

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.

EA May, June 1983 **$140.00**

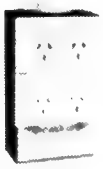
EASTERN CONVERTER!
CW/RTTY/COMPUTER

Hooks straight up to your RS232 Terminal or Teletype via 20mA loop.



RTTY COMPUTER
Connect to terminal and modem.

See EA November, 1982



POWER UP
A MUST FOR YOUR COMPUTER SYSTEM

This great new Project from EA is the answer to a Maiden's Prayer

What Does it Do?
A single 240v mains plug and lead feeds one unswitched master 240v outlet plus 4 switched 240v outlets. **With say a hi-fi system,** plug your main equipment item (eg Amp) into the master outlet and whenever you "switch on" your amp – presto – mains power is applied to the other 4 outlets ie simply "turning on" your amp turns on your tape cassette tuner turntable, graphic equaliser without mains spikes, plops, etc

Just the shot for your Computer System.

The Altronics Kit includes case and all outlets.

Cat K6000 . . . . . **$39.50**

LABORATORY MULTIMETER

100K OHMS/VOLT CHECKS TRANSISTORS AND MEASURES CAPACITANCE

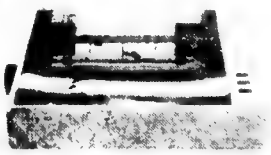
Q 1040 Multimeter	**$72.50**
Q 1041 Carry Case	**$14.50**

From Tokyo Laboratories, Japan

Remember the days when high grade precision laboratory multimeters were available only from UK and then they cost a King's Ransom?! – Well, that's history – the new Q 1040 is everything a high quality meter should be **PLUS** it checks transistor HFE and ICO and measures capacitors from 50pf-50UF

★ 100K OHMS/Volt DC ranges ★8.5 UA movement ★Fuse and diode movement protected ★Inbuilt oscillator for capacitance measurement **RANGES: DCV** 250MV, 2.5V, 10V 50V, 250V 1000V **ACV** 5V, 10V, 50V, 250V, 1000V (10K/V) **DCA** 10UA, 2.5MA, 25MA, 500MA, 10A **ACA** 10A **Resistance** x1, x10, x1K, x10K **Transistors** NPN/PNP **HFE** 0-1000 **ICO** 0-50UA **Capacitors** 50PF-3UF .01 UF-50UF

FAX-80



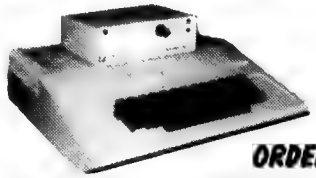
$495 plus Tax

80 column printer. Bi-directional graphics printer.

HAMPACK II MODEM!

Plugs into APPLE® or compatible computers. Software and documentation for instant CW BAUDOT, ASCII transmissions.

Can be adapted for Commodore



$210

ORDER NOW — LIMITED STOCKS

EPROMS — COPIED AND PROGRAMMED PCB's MANUFACTURED TO ORDER.

REPAIRS TO APPLE, COMMODORE & TRS 80

New Products...

New Loftek audio test set

The Loftek Audio Test Set simplifies the alignment and calibration of virtually all types of audio systems. Level calibration of tape recorders and mixing consoles, frequency response measurements and verification of signal strength throughout an audio circuit are just some of the applications of the TS-1

The LofTech TS-1 audio test set combines an audio sine wave generator with a digital meter. The generator's range extends from 15Hz to 30kHz and the meter can be switched to read either frequency or decibels. The oscillator section has an output for feeding test signals to external equipment and the meter can accept signals from the equipment under test. When a plug is inserted in the meter input socket the internal connection between the oscillator and the meter is broken, allowing the TS-1 to be used simultaneously as a signal generator and a measuring device.

When switched for signal level the meter reads whole decibels over the range of −50 to +24dB, with 0dB representing 0.775V. This reference point may be adjusted from the rear panel.

In the frequency display mode the meter responds from 1Hz to 99.99kHz. LEDs are provided to indicate Hz, kHz and dB ranges.

For additional information contact distributors, Hilotek International Pty Ltd, Miles St, Mulgrave, Vic, 3170. Phone (613) 561 2888.

New SC7000 scanner from Imark Pty Ltd

Imark Pty Ltd now has available the Saiko SC7000 scanning receiver, a compact unit which provides coverage of the VHF low band (60-90MHz), the VHF high band (140-180MHz), the UHF band (380-520MHz) and the air band. Channel steps for VHF and air bands are 2.5kHz, and 25kHz for the UHF band.

A Z80 microprocessor controls scanning functions, allowing the operator to scan between pre-set frequency limits, store up to 70 frequencies in memory and monitor and store frequencies for later recall. Two scanning speeds and a digital display of frequency and operating modes are provided together with an output for a tape recorder, a 24 hour clock and memory battery back-up.

Dimensions of the Saiko SC7000 are 270 × 90 ×30mm (W × D × H) 270 × 230 × 90 (W × D × H) and mass is 3.1kg. A telescopic whip antenna, mounting brackets for vehicle installation and an operator's manual are provided with each receiver.

Further information is available from the importers, Imark Pty Ltd, 167 Roden Street, West Melbourne, Vic, 3003. Phone (03) 329 5433.

Sheridan's sleigh the opposition with Christmas bargains

EPROM Price Blowout!!

Top quality EPROMs at rock bottom prices.

2716 EPROM **$4.00 each $3.70 10+**
2532 EPROM **$7.00 each $6.30 10+**
2732 EPROM **$7.00 each $6.30 10+**
2764 EPROM **$11.00 each $10.00 10+**

Hitachi 2114AP2

Fantastic price on brand new Hitachi 2114AP2. These are low power 200nS devices going for a song!! But stocks are limited so you'll have to be quick.

$1.30 10up **$1.50**

14 and 16 pin IC sockets

Never again at these prices. High quality AMP low profile sockets at a fraction of their usual price.

10 for $1
100 for $9

Colorburst Crystals

Going for a song!! These crystals are used in many projects and timing circuits. at these prices you can use them for experimenting etc. Solder type 4.43619MHz

Were $3.00 **only $2**

LEDs at Very Light prices!!

Scoop purchase of high quality Stanley 3mm red LEDs. Packs of 200 only at this price!!

200 for only $16.00

Centronics Plug

This is the most common plug of all on Centronics printers, computers etc. Amphenol type 57/303/60. Most of our opposition are charging around $18.00 for these connectors. Look at our Knockout Price!!

only $9.50

ONLY 1,000 available

Microprocessor Tick Tocks

Enthusiasts, get out your soldering irons. Santa Sheridan has got these amazing OKI MSM5832RS microprocessor controlled clock, calendar ICs in stock. You'll spend hours learning about all its functions. And look at this tiny price.

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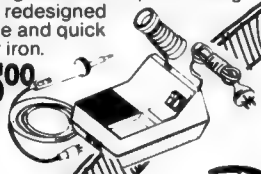

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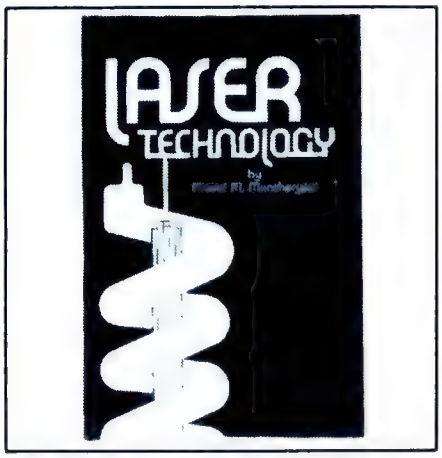


Light on lasers

LASER TECHNOLOGY by Hrand M. Muncheryan. Published 1979 by Howard W. Sams & Co, Inc. Hard covers, 145 x 223mm, 285 pages. Illustrated with many photographs and diagrams. ISBN 0 672 21588 8. Price in Australia $21.95.

Not very many books are published on this subject so this text is very welcome as it treats the subject comprehensively and is quite up to date. Inevitably though it does miss out on the laser technology used in the latest compact disc players. Apart from that it can be thoroughly recommended.

There are fifteen chapters and five appendices. Some chapter headings are as follows: Applied Laser Principles; Laser Holography; Laser Waveguide Principles; Laser Instrumentation in Medical Surgery; Laser Instrumentation in Dentistry; Laser Systems for the Military and Security Surveillance Laser Systems. Our copy came from Jaycar Electronics Pty Ltd, 380 Sussex Street, Sydney. (LDS)

Terminology explained

DICTIONARY OF AUDIO, RADIO AND VIDEO by R. S. Roberts. Published by Butterworths & Co Ltd, London, 1981. Hard covers, 140 x 220mm, 248 pages, illustrated with diagrams and circuits. ISBN 0 408 00339 1. Recommended price $42.00.

According to the jacket description, "This dictionary not only provides clear definitions of all the terms now currently in use in the UK and USA, but also explains many terms in depth; illustrations and extensive cross-references are included to assist the reader's understanding."

And that is a fairly accurate description of the book. One might quibble over the word "all" but it is fair description. More important, perhaps, is the extent to which various terms are defined. This can vary from one or two lines to more than half a page, plus diagrams and cross references. In this respect the book tends to be more of an encyclopaedia than a dictionary, though the author does not claim this.

On the other hand, the author points out that there has been no attempt at a "textbook" approach to these definitions; merely an attempt to point the way to more detailed study, if needed. Nevertheless, where desirable to assist the explanation, appropriate formulas have been included.

By their very nature, books of this kind tend to be of limited value to the individual, but would be appropriate in technical education and other libraries.

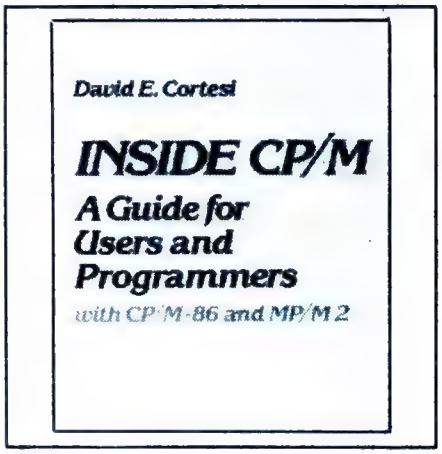
Our copy from Butterworths Pty Ltd, Box 345, North Ryde, NSW. (PGW)

TRS-80 Color Computer

MAKING THE MOST OF YOUR TRS-80 COLOR COMPUTER by Peter Vernon. Published by Prentice-Hall of Australia, 1983. Soft covers, 152 x 230mm, 192 pages. ISBN 0-13-547647-X. Price in Australia $14.95.

Since this book is written by one of our staff, we are not really in a position to give a truly objective review. However, in nine chapters the author gives readers a good introduction to the TRS-80 Color Computer. He deals at some length with Color Basic statements and functions and gives valuable insights into the graphic and sound features of Color Basic with over a 100 sample programs.

There are also appendices for the Color Computer character codes, musical notation, machine language and Hexadecimal. (LDS)



A detailed guide to CP/M

INSIDE CP/M: A Guide for Users and Programmers by David E. Cortesi. Published by CBS College Publishing, NY, 1982. Soft covers, 188 × 236mm, 570 pages ISBN 0 03 059558 4. Price $41.95.

This perhaps the most detailed and comprehensive book on CP/M available. In coverage and detail it sets a standard which other writers would do well to emulate, and although written for newcomers to computing as well as the more experienced it truly does have something to say to everyone.

The text is divided into two sections; a tutorial which presents the fundamentals of using and programming a small computer with CP/M, and a reference guide for programmers, organised and indexed for ready reference.

The tutorial section is further subdivided into four parts. The first four chapters introduce the newcomer to computers and CP/M, explaining the components of a computer system and defining systems and application programs. Valuable guides to drives and printers are provided, and in addition there are section on shopping for a computer system, organising the computer workplace and insuring against the loss of the system or valuable data.

Chapters five to eight introduce the new user to the CP/M operating system. The keyboard and the process of bringing CP/M up on a computer are discussed first, followed by descriptions of the most commonly used commands and the file system. Separate chapters are included on the use of PIP, (Peripheral Interchange Program) for file transfer, and on ED, the CP/M line editor. Organisation of disk libraries, hard disks and the use of the SYSGEN and SUBMIT utility also receives a separate chapter.

Chapters 9 to 12 address the facilities provided by CP/M. Starting with binary data and number systems and the representation of data, this section takes the reader step by step through some of the intricacies of the operating system, including the organisation of disks and files. Chapter 11 describes some of the languages available under CP/M, and discusses the merits of compilers and interpreters, while Chapter 12 describes the use of assembly language and DDT, the Designer's Debugging Tool.

Section Four of the tutorial system is for experienced programmers who wish to learn how to access the Disk Operating System of CP/M using assembly language. Again the coverage is complete and detailed, including service requests, opening and writing files, format of directory entries and the use of program libraries. Interfacing to the Input/Output System is also covered in detail for CP/M, MP/M and the 16-bit CP/M-86 versions of the operating system.

Section one of the book, occupying perhaps half of the 570 pages, has its own index and a glossary. It is followed by the reference guide, which consists largely of summaries and charts of instructions, I/O assignments, ASCII and hex values and the 8080 and Z80 microprocessor instruction sets. A separate section covers the use of the assembler, and further summaries are provided of all features of the BDOS and BIOS components of CP/M.

Detailed summaries and maps of CP/M memory use, directory format and the configuration of the CP/NET networking system conclude this section.

Considering the amount of material covered and the detail provided, "Inside CP/M" will be a valuable addition to the library of anyone using or considering using CP/M. It is clearly written and well organised and has something for everyone, from the beginner to the advanced programmer. Highly recommended.

"Inside CP/M" is available from Altronic Distributors and their re-sellers throughout Australia. (PV)

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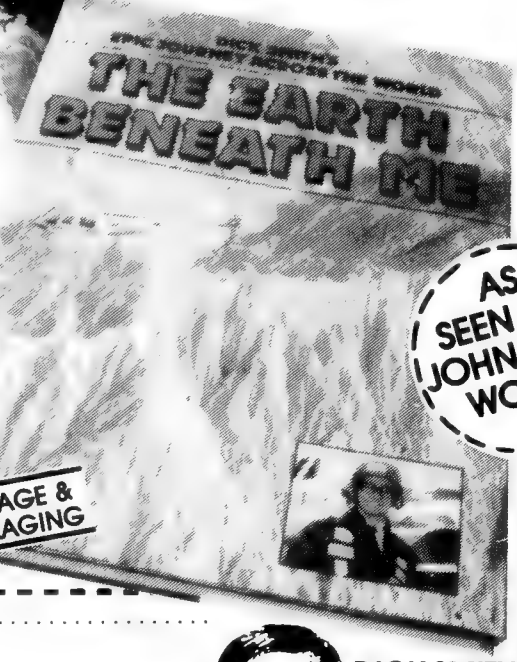

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50 & 25 YEARS AGO

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly

December 1933

Radio City: New York's "Radio City", which opened on November 15, has a central tower 836 feet or 70 storeys high; the closely-placed upright steel pillars needed for such a tall building make it impossible to put wide studios there, so they have put the studios at the foot of the tower, in a building only 12 stories high. The 35 studios cover about 400,000 square feet.

The ninth floor claims the largest studio in the world – 78 x 132 feet, and 35 feet high. On part of the 10th floor are four studios arranged like a clover-leaf around a control room; the floor of the control room moves round, so that television apparatus of the future may be quickly focussed into any of the studios through sound-proof glass.

☆ ☆ ☆

Pedal wireless and the flying doctor: A feature article in the December 15 issue described the Australian Inland Mission flying doctor service which was then about five years old, a station having been established at Cloncurry in 1928.

The system consisted of base stations transmitting voice messages to the outstations, with the outstations replying in Morse code. The outstation transmitters were powered by pedal driven generators and the Morse code characters were generated by a typewriter-like keyboard, to permit operation by unskilled persons.

☆ ☆ ☆

Looking still further back: The December 1, 1933 issue reminded readers that this was the 10th anniversary of broadcasting in Australia. It reproduced the diagrams of two crystal sets and two one valve sets which had been presented in "Wireless Weekly" 10 years previously.

Two hundred metres and down: The British RAF is abandoning the long waves for the 20 to 100 metre band, especially for long-distance work in the East, using a special three-valve receiver with an amplifier employing two stages of screen grids in push-pull.

☆ ☆ ☆

Patent problems: As we go to press we learn unofficially that the STC-Philips-AWA patent-holding group is going to make a charge of 3/6 per valve socket, with slight reductions in certain cases. For the home builder a licence will be issued at half this figure – 1/9 per socket. So far it is not clear how this amount is to be collected, and at a glance it appears as though the collectors of the amount will have great difficulty in deciding whether a home-built set is being worked upon by an experimenter "with a view to furthering or improving the art". If a home builder can prove that he is an experimenter working in this manner, then it appears that he will be justified in refusing to pay any royalty at all.

RADIO TELEVISION AND HOBBIES

December 1958

Birth of atomic timekeeping: Main exhibit at the recent "Pendulum To Atom" exhibition at the Goldsmiths Hall in London was the Caesium Atomic Clock.

Developed by scientists at the National Physical Laboratory, the atomic clock is so accurate that it loses only one second every 300 years and needs one gallon of water every minute to keep it cool.

It is possible to achieve this degree of precision because of the extreme stability of the fundamental properties of the atom, which are also independent of all external parameters, such as temperature, with the exception of magnetic field.

The National Physical Laboratory use the clock to calibrate the standard quartz oscillators.

So it's not new after all: A new radio broadcasting system that provides full stereophonic sound through a single receiver and dual speakers on the regular AM broadcast band was unveiled recently by the Radio Corporation of America.

The experimental system was demonstrated for the first time to an audience of broadcast station executives at RCA's David Sarnoff Research Centre at Princeton, New Jersey.

A standard AM signal is made up of a carrier wave and two symmetrical sidebands of slightly higher and lower frequencies to either side of the carrier. In the stereo system demonstrated to the broadcasters, each of the stereo channels is carried by one of these sidebands.

In the stereophonic AM receiver, the two sidebands are separated and fed to two speakers, left and right, to reproduce the stereo effect picked up at the studio.

The stereophonic receiver also can pick up non-stereo broadcasts and play them through either speaker or both, without any stereophonic effect.

(Editor's note: this would appear to be very similar to the present day Kahn system which uses upper and lower sidebands.)

☆ ☆ ☆

TV relay satellite: A soviet satellite for relaying TV broadcasts appears to be in the planning stages. Such a scheme was recently described by scientist Druzhkin and engineer Sorin in the magazine "Knowledge Is Strength". They envision for Moscow a future audience taking in Europe, Asia, Africa and Australia.

Druzhkin and Sorin say a relay satllite should be fired to a height of 36,000 kilometres (22,350 miles), at which it would move at a speed equal to that of the earth's rotation around its axis; it would, in effect, hang over a given spot on the earth's surface.

They estimate two kilowatts are needed to power the transmitting apparatus. They propose to use solar batteries at first and switch later to small nuclear reactors.

☆ ☆ ☆

Project Plowshare: Atom bombs for war will eventually give way to atom bombs for peace as we learn to use the huge explosive power to perform useful work.

It may be possible to rejuvenate old oil fields, open up vast deposits of low grade ores, and create huge underground water reservoirs for arid regions, all with atomic bombs.

This is the opinion of American scientists who are studying the results of deep underground atomic blasts that they touched off this year and last at their Nevada test site.

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Letters to the editor

Will the real Murphy please stand up!

I was just re-reading some old numbers of EA, and on p107 of March 1975 EA I noticed another reference to Murphy's Law. I get the impression that most people think it is some kind of a joke; but now it seems that Murphy is a real person. He is Air Force Captain Edward A. Murphy Jr. who had a hand in designing the harness that held Major John Paul Stapp when they were trying to find the limits of human endurance to acceleration.

There were 16 sensors on the harness, and after one test they had all read zero. Someone had connected them all the wrong way round. This was the occasion for Murphy to state: "If there are two or more ways to do something, and one of these ways can result in a catastrophe, then someone will do it." The aim of Murphy's Law is that equipment should be so designed that it will be difficult, or impossible, to connect it wrongly.

The humorous popular version, with its fatalistic acceptance of the inevitable, perverts his original concept of a sort of moral to help prevent accidents.

The above information is taken, in some cases verbatim, from p78 of the Jan./Feb. issue of "Science 83".

Quite possibly others may have written to you about this, but there is also the possibility that they may not have done so. I think that not only is this an interesting piece of information, in view of the popular expression of Murphy's Law, but in its original form it is an adage worthy of being taken seriously by those who are concerned with the design of modern technical equipment. Maybe it would be good if Edward A. Murphy Jr. went down in history as more than just a joke.

Ronald W. Fiegert,
Finschhafen, Papua New Guinea.

Valves resurrected. . .

So "Valves are Dead"! Then so must I be (see article on p94 of EA, September 1983). In the last year or two I have constructed eight or ten projects for myself and others. Of this number the following were valve devices: a communications receiver (10 tubes); a hifi tuner (10 tubes); an AF equaliser (3 tubes) (tubes are heated by DC, fed from a 2N3055 regulator); a regulated power supply (4 tubes); an 8MHz oscilloscope (11 tubes); and a 250W VHF amplifier (14 tubes).

Valves are not dead — all the foregoing things work! What is dead, of course, is the supply of coils for AM valve receivers.

Transformers can be arranged along the lines you have described — though there are other ways. Valves can be obtained too — there are several Australian suppliers, two in particular, who stock most of the major usage types of the last 50 years.

Might I comment on the Reinartz mode receiver — the old "three band two". Getting one of these to run nicely is akin to learning digital electronics using a 6800 chip as a starting point. Running high slope pentodes like 6U8's or 6BL8's etc into a cathode coupled regeneration circuit is the thing of which parasitics and paranoia are born.

The real way to go for a two tube terror is to run a high slope mixer such as a 6AJ8 into a single IF transformer. The two coils in this will provide superior selectivity and gain compared with a regenerative horror. The signal thence proceeds to a diode high slope pentode such as 6BV7. Power supply under the Marquis of Queensbury (RF) rules can be diode rectifiers; after all, selenium rectifiers were used way back.

As I remarked earlier, the real problems are the three coils; aerial, oscillator and IF transformer. Winding the first two isn't too hard, but the IF transformer is a bit more painful. However, one of your regular advertisers (L.E. Chapman) still offers them. Also, they could be wound, at a pinch.

B. M. Byrne,
Indooroopilly, Qld.

Comments on record reviews

I would like to support the plea for broadening the scope of your record reviews. Whilst not being one of the younger readers referred to I do include myself in the ranks of electronic music lovers and admit to a craving for more than perpetual pop or wallpaper music. Your reviews enable me to learn some of what is to be heard by way of non garbage without becoming a musician. But only just.

To argue for a certain type of music begs the question of how to define what is good, but I have been driven to despair by the apparent rule that if a track doesn't have a vocal in it then it is unbroadcastable. Having to endure vocalists that can't sing, opening their mouths and ruining what promised to be a very interesting track, I strongly support the idea of your column giving a little more attention to the instrumental scene.

Such music is worth paying good money for but unfortunately recording companies and general retailers seem to be geared to the charts and if a release doesn't sell like hot cakes it is withdrawn. An artist daring to be different is battling and the discerning listener whose taste falls between the pops and classics has to be quick off the mark to catch it if indeed it ever finds its way into the typical local shop.

Each month I scan your reviews with a faint hope of picking up something different and now and again it pays off. But generally the selection is very narrow. Surely with a bit of prodding it might be possible to convince the industry that there is a market for up to the minute instrumental works if only the public knew the stuff had been recorded.

Ray Foster,
Darlington, W.A.

The myth of Edison

I am surprised that the myth of Edison and the carbon filament electric light bulb has once again been published, this time in your September article on Nikola Tesla.

As far as I am aware, Edison got stuck with platinum filaments at the same time that Joseph Swan was demonstrating his carbon filament bulbs in lighting the Savoy Hotel in London. Swan was unable to sell his ideas in very conservative England, so he went into partnership with Edison in the Edison-Swan Electric Light Co., to produce the Ediswan lamps.

G. Nichols,
Electrojac,
Waiotemarama, Hokianga,
New Zealand.

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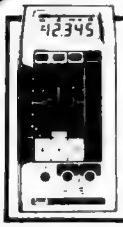

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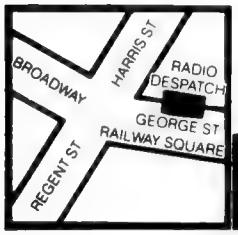

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8T96 2.30
8T97 2.30
11C90 14.00
95H90 14.50

MICRO
2102 2.40
2112 8.00
2114 2.50
2532 6.95
2564 16.50
2708 8.00
2716 4.95
27128 55.00
2732 6.80
2764 9.50
2816 40.00
2911 32.00
2912 22.00
2920 120.00
4116 150NS 2.96
4164 150NS 8.95
8116P3 9.90
6502 10.20
6502A 10.80
6505 13.50
6507 9.60
6520 3.40
6522 9.00
6522A 11.80
6532 12.00
6545 22.00
6551 17.00
6800 5.60
6802 8.60
6808 5.00
6809 16.00
6810 3.85
6820 3.40
6821 3.55
6840 6.60
6844 15.50
6845 15.50
6847 8.80
6850 3.80
6852 4.20
6854 9.60
68A09 36.00
68B00 9.90
68B21 4.40
68B40 8.40
68B45 18.20
68B50 4.90
68B54 12.40
8080 6.90
8085A 10.80
8086 59.00
8088 48.00
8155 9.80
8156 9.80
8185 39.00
8202A 60.00
8203 65.00
8206 120.00
8212 3.80
8214 9.50
8216 3.70
8224 4.80
8226 3.70
8228 7.80
8231 285.00
8237 47.00
8238 11.90
8243 7.90
8251A 8.50
8253 9.00
8255A 6.95
8257 11.90
8259 10.90
8271 106.00
8272 33.00
8273 65.00
8274 46.00
8275 46.00
8276 26.00
8282 8.50
8283 8.40
8284 11.00
8286 8.40
8287 8.40
8288 26.50
8289 35.00
8291A 47.00
8292 38.00
8293 29.00
Z80CPU 5.40
Z80ACPU 5.90
Z80BCPU 11.20
Z80P10 5.15
Z80AP10 5.80
Z80510 14.50
Z80A510 16.00
Z80CTC 5.30
Z80ACTC 6.50
Z80DMA 15.50
Z80ADMA 19.50
8741A 39.50
8748-8 35.00
8749 55.00
8755A 39.00

VOLT REGS
LM309H 3.90
LM317HVK 7.50
LM337T 2.20
LM337HVK 12.00
LM337K 6.80
LM338K 8.60
LM350K 6.30
LM350T 4.50
LM396K 18.90
LM79L05 .70
LM79L12 .67
LM79L15 .62

SH1605 17.40
UA317T 1.40
UA317K 4.80
UAA309K 2.40
UA494 5.04
UA7805 .84
UA7805K 2.16
UA7806 .94
UA7808 .82
UA7808K 2.38
UA7812 .78
UA7812K 2.38
UA7815 .72
UA7815K 2.38
UA7818 .82
UA7818K 2.38
UA7824 .82
UA7824K 2.38
UA78H05K 8.30
UA78H12K 9.95
UA78HGKC 10.00
UA78L05 .46
UA78L12 .50
UA78L15 .46
UA78M05 .82
UA78M12 .82
UA78P05K 15.70
UA78S40 3.50
UA7905 .96
UA7905K 2.35
UA7908 .96
UA7908K 2.38
UA7912 .96
UA7912K 2.35
UA7915 .98
UA7915K 2.38
UA79HGKC 16.90
UA79M05 .90
UA79M12 .90

OPTO
4N25 1.20
4N26 1.20
4N28 1.20
4N32 1.20
4N33 1.50
4N35 1.20
MCT6 1.90
MCT2 1.20
FND357 2.90
FND500 1.98
FND507 1.98
FND800 4.20
TIL31A 2.50
TIL81 2.00
BPW50 2.00
CQY89 .75
MOC3020 2.90
MOC3021 2.98
MAN72A 1.50
MAN74A 1.50
FCD820C 1.10
FCD825C 1.10
FCD850C 1.50
FPT100B 1.50
MSM3914 8.50
MSM3916 8.50

LEDS
TLG123 SGS
3mm GREEN 16
TLR123 SGS
3mm RED 10
TLO123 SGS
3mm YELLOW 16
TLG113 SGS
5mm GREEN 16
TLR113 SGS
5mm RED 10
TLO113 SGS
5mm YELLOW 16
Z0160
RECT RED 25
Z0162
RECT GREEN 25
Z0164
RECT YELLOW 25
FLS010
5mm LED CLIP 04

DIODES
1N4148 05
1N914 05
1N4001 06
1N4002 06
1N4004 08
1N4007 12
1N5404 24
1N5408 27
OA47 46
OA90 18
OA202 1.14
OA636 96
P600G
6A400V 59
BAW62 30
BA102 70
OA91 27
OA95 26
IN3492
25A100V 2.10
IN3492R
25A100V 2.10
1N5060 35

BRIDGES
VJ448
10A400V 2.20
BR154
15A400V 3.50
BR254
25A400V 3.95
BR354
35A400V 4.50
P04
6A400V 1.50
RS204
2A400V INLINE 96
SB204
2A400V 75
W04
1.5A400V 48

ZENERS
IN4733A
5.1V 1 WATT 74
IN4734A
5.6V 1 WATT 24
IN4736A
6.8V 1 WATT 24
IN4740A
10V 1 WATT 24
IN4742A
12V 1 WATT 24
IN5349B

12V 5 WATT 1.10
BZX61/C75
75V 1.3 WATT 1.10

TRANSISTORS
AC126 .70
AC127 .60
AC128 1.20
AC187 .70
AC188 1.30
AD149 2.10
AD161 1.70
AD162 1.70
AF127 1.25
BC107 .35
BC107B 40
BC108 .35
BC108C 40
BC109 .35
BC109C 40
BC177 40
BC178 42
BC179 42
BC212 25
BC318 18
BC327 18
BC328 18
BC546 18
BC547 12
BC547C 18
BC548 12
BC548C 18
BC549 12
BC549C 18
BC550 18
BC556 18
BC557 12
BC557B 18
BC558 12
BC558B 18
BC559 12
BC559B 18
BC637 42
BC639 40
BC640 40
BCY70 52
BCY71 64
BD135 44
BD136 55
BD137 47
BD138 57
BD139 50
BD140 50
BD233 55
BD235 55
BD236 55
BD237 72
BD238 57
BD262 96
BD263 94
BD437 62
BD647 2.20
BD677 81
BD681 71
BD682 71
BF64B 2.80
BDV65B 2.80
BDY96 3.50
BDY97 3.50
BF115 75
BF167 75
BF173 70
BF180 1.06
BF184 78
BF198 22
BF199 22
BF337 86
BF458 68
BF459 70
BF469 95
BF470 95
BF494 31
BFY50 69
BFY90 1.10
BU126 2.90
BU208 2.90
BU326A 2.90
BUX80 3.95
MFE121 1.45
MFE131 1.80
MJ413 4.90
MJ802 6.50
MJ1001 2.90
MJ15003 5.50
MJ15004 5.50
MJ2955 1.70
MJA032 9.80
MJA035 11.20
MJA502 5.20
MJE340 80
MJE350 1.30
MJE521 1.25
MJE700 69
MJE800 61
MJE2955 2.20
MJE3055 2.20
MPSA05 19
MPSA06 19
MPSA12 20
MPSA14 24
MPSA42 27
MPSA56 21
MPSA92 25
MPF102 56
MPF103 79
MPF105 79
MRF237 4.50
MRF454 35.00
MRF475 6.50
MRF901 3.30
TIP31 53
TIP31A 54
TIP31B 60
TIP31C 85
TIP32 66
TIP32A 67
TIP32B 79
TIP32C 80
TIP41 99
TIP41A 1.06
TIP41B 1.14
TIP41C 1.16
TIP42 93
TIP42A 1.25
TIP42B 1.30
TIP42C 1.32
TIP111 1.04
TIP112 1.10
TIP116 1.17
TIP117 1.45
TIP120 84

TIP122 92
TIP125 99
TIP127 1.60
TIP2955 1.87
TIP3055 1.14
2N301 4.30
2N697 59
2N918 65
2N2219 60
2N2219A 65
2N2222 42
2N2222A 48
2N2369 60
2N2484 60
2N2646 96
2N2647 2.50
2N2894 53
2N2904 73
2N2905 73
2N2905A 73
2N2906 73
2N2907 50
2N2907A 60
2N3019 69
2N3053 64
2N3054 2.25
2N3055 1.30
2N3302 53
2N3440 1.13
2N3441 2.60
2N3442 2.78
2N3563 18
2N3564 18
2N3565 18
2N3566 18
2N3567 18
2N3568 18
2N3569 18
2N3638 18
2N3640 18
2N3641 18
2N3642 18
2N3643 18
2N3644 18
2N3646 18
2N3702 27
2N3704 25
2N3771 4.85
2N3772 4.85
2N3773 5.40
2N3819 80
2N3866 1.26
2N5089 20
2N5109 20
2N5179 1.56
2N5190 86
2N5191 88
2N5192 98
2N5193 81
2N5195 56
2N5210 24
2N5245 83
2N5303 4.70
2N5401 20
2N5457 60
2N5458 68
2N5459 74
2N5461 82
2N5485 72
2N5486 82
2N5590 17.80
2N5591 20.00
2N5770 19
2N5777 1.20
2N5873 1.75
2N5944 15.50
2N5946 24.50
2N5961 25
2N6027 58
2N6084 22.00
2N6121 77
2N6122 77
2N6123 74
2N6124 78
2N6125 81
2N6126 98
2N6129 1.40
2N6130 1.80
2N6131 1.80
2N6133 1.95
2N6696 1.30
2N918 65
2SA683 70
2SC1017 3.10
2SC1061 83
2SC1096 86
2SC1106 4.80
2SC1226 95
2SC1306 1.50
2SC945A 39
2SD350A 3.30
2SJ49 6.50
2SK134 6.50
3N201 2.18

SCR & TRIACS
C103D 79
C106D 96
C122D 1.75
C122E 2.30
C230D 6.80
Q4010L4 1.90
Q4015L5 2.70
Q6010L5 3.20
Q6015L5 3.50
Q6025H 9.80
S4015L5 2.20
S4025H 8.20
SC141D 1.35
SC146D 1.92
SC151D 2.84
ST2 62
ST4 80

TANTALUM
1UF 35V 29
22UF/35V 29
33UF/35V 29
47UF/35V 29
1UF/35V 30
1.5UF/35V 30
2.2UF/35V 35
3.3UF/35V 35
4.7UF/35V 52
10UF/35V 66

ELECTRO PCB
1UF/50V 15
2.2UF/25V 15
4.7UF/25V 15
10UF/25V 15
33UF/25V 15
47UF/25V 15
100UF/25V 16
220UF/25V 20
330UF/25V 35
470UF/25V 42
1000UF/16V 45
1000UF/25V 60
2200UF/25V 1.20

ELECTRO AXIAL
47UF/63V 20
1UF/63V 20
2.2UF/63V 20
3.3UF/25V 20
4.7UF/25V 20
10UF/160V 35
10UF/16V 20
10UF/25V 22
10UF/63V 25
22UF/25V 24
22UF/63V 28
47UF/16V 22
47UF/25V 24
47UF/63V 29
100UF/25V 31
100UF/63V 45
220UF/16V 25
220UF/25V 35
220UF/63V 65
470UF/16V 48
470UF/25V 50
470UF/63V 80
1000UF/16V 55
1000UF/25V 82
1000UF/35V 98
2500UF/16V 1.14
2500UF/25V 1.50
2500UF/35V 1.90
2500UF/50V 2.60
4700UF/35V 3.45

ELECTRO METAL CAN
2500UF/80V 3.50
4000UF/75V 5.80
5600UF/40V 4.10
8000UF/75V 8.95

ELECTRO BIPOLAR
2.2UF/50V 35
4.7UF/50V 38
6.8UF/50V 39
10UF/50V 40
22UF/50V 46

GREENCAPS
001UF/100V 12
0015UF/100V 12
0022UF/100V 12
0033UF/100V 12
0039UF/100V 12
0047UF/100V 12
0056UF/100V 12
0068UF/100V 12
0082UF/100V 12
01UF/100V 12
015UF/100V 12
022UF/100V 12
033UF/100V 12
039UF/100V 12
047UF/100V 14
056UF/100V 14
068UF/100V 18
082UF/100V 18
1UF/100V 18
15UF/100V 18
22UF/100V 18
27UF/100V 22
33UF/100V 30
47UF/100V 34
1UF/250V 85
2.2UF/250V 1.25
3.3UF/250V 2.30
4.7UF/250V 2.80
6.8UF/250V 4.40
10UF/250V 5.90

GREENCAPS HIGH VOLTAGE
01UF/630V 22
022UF/630V 24
033UF/630V 26
047UF/630V 30
1UF/630V 38
22UF/630V 45
33UF/630V 46
47UF/630V 50

CERAMIC
1PF 08
1.5PF 08
2.2PF 08
2.7PF 08
3.3PF 08
3.9PF 08
4.7PF 08
5.6PF 08
6.8PF 08
8.2PF 08
10PF 08
12PF 08
15PF 08
18PF 08
22PF 08
27PF 08
33PF 08
39PF 08
47PF 08
56PF 08
68PF 08
82PF 08

STYROSEAL
56PF 630V 25
68PF 630V 25
82PF 630V 25
100PF 630V 25
120PF 630V 25
150PF 630V 25
180PF 630V 25
220PF 630V 25

MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER MAIL ORDER

GO ANYWHERE - 12-240V POWER $199.50

MASSIVE 300 WATTS

These great inverter kits enable you to power 240V appliances from a 12V DC power source. Tremendous for camping, fishing etc. Install into your Car, Boat or Caravan.

A fully regulated and overload protected design featuring XTAL locked frequency. Use to power hi-fi, TV sets, even electric drills for short time periods.

MANY OF THESE KITS ARE NOW IN USE FOR EMERGENCY LIGHTING PURPOSES.

KIT features ☆ Gold plated edge connector and PCB buss ☆ Low age rate XTAL ☆ Sockets for all IC's ☆ High Efficiency Transformer

ACTIVE ELECTRONICS
4 KING STREET SANDRINGHAM VICTORIA 3191
PHONE (03) 521 2103

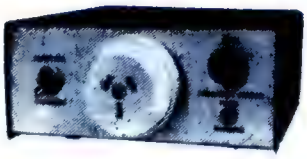
PRESTIGEOUS NEW TOUCH LAMP DIMMER

HALF THE COST OF COMMERCIAL UNITS

$19.50

Great new kit from EA (April 83). Based on new Seimens ICS576A Light Dimmer IC instantly turn lamps on and off with just a light touch on a wall panel or provide mood lighting by touching the panel for a few seconds. The Altronics kit is complete in every way including satin silver touch plates for that touch of class.

TWO GREAT 40 WATT MODELS

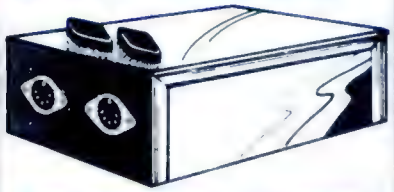


GENERAL PURPOSE

Suits small appliances, ie Turntables, Tape Decks, Shavers etc. Variable frequency adjustment enables speed control of turntables. Works as a trickle charger when mains power is available.

EASY CONSTRUCTION ☆ VALUE PLUS

$55-00



FLUORESCENT LIGHTING

Operates above the audible frequency range and is capable of driving one 40 watt or two 20 watt fluorescent tubes to 150% of their normal 240V efficiency. Install permanently into caravans. **COMPLETE BOXED KIT, INCLUDING ALL WINDING WIRE.**

$37-50

TRANSISTOR TESTER

Electronics Australia Project. Tests Bipolar Transistors, Diodes, Fets, SCR's and PUT's. Excellent service aid for the hobbyist and serviceman. Complete kit and instructions.

K 2525

$19-75

SATURDAY ARVO KITS

RADIO MIC K1106	$6.50
ALIEN INVADERS K1123	$13.95
SOUND BENDER K1492	$29.50
COURTESY LIGHT EXTENDER K4232	$3.95
SOUND EFFECTS PACK K1607	$17.50

(CONTAINS PARTS FOR ALL 5 PROJECTS)

ACTIVE NOW STOCK A FULL RANGE OF KITS PHONE FOR FURTHER DETAILS OF KITS AVAILABLE

EPROM PROGRAMMER

$55

ETI JAN'83

Versatile, low cost and easy to build. Plugs straight into the microbee I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 Eproms. Burn your games programmes and eliminate cassette loading time.

KIT FEATURES ☆ Sockets for all other IC's ☆ 1 x 2716 supplied — get started straight away ☆ Front Panel and Mains (SEC approved) transformer ☆ 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included) ☆ DB15 Plug ☆ Complete to last nut and bolt

POWER SUPPLY

BASED ON EA LM 317K PROJECT

Every workshop, school and hobbyist should get one now!

- Overload and short circuit protected
- Full voltage and current metering
- 3-32 volt output at 1 AMP
- Uses LM 317K variable regulator
- Full instructions and every last part included.

$39-95

DIGITAL FREQUENCY METER

See Electronics Aust. Mag. Dec. 81-Feb. '82

500 MHZ, 7 DIGIT RESOLUTION PLUS PERIOD MEASUREMENT FEATURE

★ Prepunched and screened front panel, no drilling or filling required. ★ Bright high efficiency 7 segment display. ★ Frequency ranges 0-10MHz, 0-50MHz, 10-50MHz (with optional pre-scaler) ★ 4 gating times — 01, .1, 1, 10 seconds. ★ 4 period measuring ranges 1, 10, 100 and 1000 input cycles give 0.1uS resolution. ★ High input sensitivity — 10mV to 30MHz, 100mV at 50MHz @ 1M input impedance, 200mV at 500MHz @ 75 ohms input impedance. ★ High accuracy — typically better than .005%/count uncalibrated.

Costs a fraction of commercial counters.

EXCLUSIVE KIT FEATURES:

- IC sockets provided throughout.
- Low aging 10,000 MHZ XTAL.
- Thermalloy heatsink for 5V regulator.
- Quality Pactec Instrument Case with tilting bail.

K 2500 (50 MHZ version) $119.50

K 2501 Pre-scaler . . . . . $ 26.00

(add for 500 MHZ version)

IMPORTANT NOTES:

(1) This project is well within the scope of the "not so experienced" as virtually all components are contained on a single PCB.

(2) USE ONLY THE SPECIFIED INTERSCIL LSI — BEWARE OF INFERIOR KITS THAT DO NOT CONFORM TO THE ORIGINAL DESIGN.

DIGITAL CAPACITANCE METER

Electronics Australia Project. Measures 1PF to .99 UF. 240V Mains Powered. Bright LED Display. Easy to build. Complete kit of parts and full instructions.

K 2520 **$45**

Shortwave Scene

by Arthur Cushen, MBE

FEBC operating from Saipan on shortwave

The Far East Broadcasting Company has begun operating from Saipan in the Northern Marianas. The shortwave service follows the introduction of a medium wave station and joins KYOI as a second signal from Saipan.

With the callsign KFBS and using 100kW, this is the first of five transmitters; a further transmitter will be delivered this month, while three more are expected to begin operation in 1984. KFBS's first 100kW transmitter was first used in 1942 as KGEX San Francisco and later was located at the VOA Okinawa transmitting site while the other four units to be installed will be new 100kW transmitters. The initial broadcasts are being carried on a three beam antenna system.

The tentative schedule is 0900-1100UTC on 15115kHz in Russian; 1100-1300UTC on 15150 in Mandarin; 1300-1400 on 9575kHz in Russian and 1500-1600UTC on 15110kHz in Ukranian.

FEBC Saipan has been operating for some months on medium wave as KSAI 936kHz, and has increased power to 10kW with the installation of a new 75 metre tower.

VOICE OF PEACE

Verification has been received of reception of The Voice of Peace operating from a ship located nine kilometres from Tel Aviv. Broadcasts on 6240kHz have been heard at around 2030UTC and according to Stuart Vint, Station Engineer, the transmitter is a home-made 400W unit. Plans are under way to increase the power to 10kW and use the present frequency to evaluate reception. The address of the station is The Voice of Peace, PO Box 4399, Tel Aviv, Israel, and the verification is a handwritten letter.

DIXON REACTIVATED

The Voice of America relay station at Dixon, California, has been reactivated after being in mothballs for several years. The site south of San Francisco was first used in 1942 for Office of War Information transmissions and in 1944 became a relay base for the Voice of America, with the major antenna systems beamed on the South Pacific. Transmitters were extended and in 1969 when the writer visited the station new 250kW units were being installed. By 1976 the transmitting site had eight transmitters – three 250kW, one 200kW, two 100kW and two 50kW units. VOA Dixon operates 1130-1400UTC on 6040, 9540, and 11920kHz and at 0000-0300 on 9505, 11950 and 15250kHz to the Caribbean area.

AMERICAN NEWS

ARGENTINA: According to a report from Gabriel Ivan Barrera of Buenos Aires in the NZ DX Times, Radio El Mundo and Radio Splendid have ceased shortwave transmissions and now operate only on medium wave and FM. This will mean that 5985, 6120, 9710, 9740, 11755, 11880 and 15280kHz have been vacated and could be used by Radio Argentina Exterior.

BRAZIL: Radio Braz, Brazilia operates on 15290kHz with two transmissions in English 1800-1900UTC to Europe and 0215-0315UTC to North America. This new frequency provides good reception at 1900 after the English program when German is carried up to 1955UTC.

USA: KGEI San Francisco has been heard with a Russian broadcast on 9675kHz, opening at 0930UTC and switching to Japanese at 1130UTC with gospel programming to close-down at 1230UTC.

NEW BBC TRANSMITTING SITE

Plans for a £40 million transmitter site have been announced as part of a 10 year plan by the United Kingdom Government to increase the audibility of the External Service of the BBC. The intention of the program is to provide modern transmitters and antenna arrays of sufficient power to maintain improved reception qualities and keep abreast of the increased power used by the BBC competitors. One proposal is for an expansion of the External Services of the BBC and the site will house six 300kW transmitters and 30 associated antenna systems about seven kilometres north of Stratford on Avon in Warwickshire. Because of technical problems the existing BBC sites at Skelton, Rampersham, Woofferton and Daventry cannot be extended. The Crowborough station which consists of two 100kW transmitters will cease to operate and the new transmitters will be operated by the Communications Engineering Department of the Foreign Office, which currently operates the Crowborough station and the relay bases at Cyprus and Masirah.

SCHEDULE CHANGES

AUSTRIA: Broadcasts from Vienna to Australia are 0700-0900UTC on 15270 and 17830kHz and 1000-1200UTC on 15420 and 17825kHz. English is carried at 0830-0900 and 1030-1100UTC. Transmissions to the Far East are at 1300-1500UTC on 15290kHz and 2100-2300UTC on 7170 and 9740kHz.

BELGIUM: Brussels broadcasts in English at 1915-2000 on 5985 and 15590kHz, 2200-2245UTC on 5895 and 9900 and 0030-0115UTC on 5910 and 9880kHz.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.

REVIEWS OF RECENT
Records & Tapes
CLASSICAL • POPULAR • SPECIAL INTEREST

MENDELSSOHN

Symphonies Nos 4 and 5. Berlin Philharmonic Orchestra conducted by Lorin Maazel. DGG Resonance Series (analog) 2535 171.

I have a vague idea – which I have been unable to confirm – that when this performance was released many years ago it was thought in some quarters to be a rival to Toscanini's. This was in a period of almost mystic reverence for Toscanini.

The reason for this worship was that he could always be relied upon to play the music strictly as it was indicated in the score and on this his concentration was magnetic. But his sheer personal drive prevented any hint of coldness in his readings. One felt one was in the presence of controlled incandescence.

If this praise was merited it could easily have spoiled the talented young Maazel who, however, has continued, unaffected, to follow his brilliant career. Now for a few words about the Fifth. Mendelssohn was of Jewish stock though his father deserted his faith and turned Christian – to not much purpose to his son in later Nazi years. In 1962 I was in Hamburg and went to a very good restaurant in the basement of the Town Hall. There on the pedestal of one of the columns that support the building were engraved the names of famous German composers born in that city. In 1962 Mendelssohn's name had still been left erased. This is strange because the young Mendelssohn had embraced his new faith with all the excited enthusiasm of the convert. This is shown in the Fifth by his bold quotations from the Lutheran litany in his music – the Dresden Amen at the beginning, a phrase also used by Wagner as part of the Grail Theme in Parsifal, and a fantasia, in the Finale, of the Lutheran hymn Ein Fest Burg is Unser Gott. The attestations of faith were almost truculently included in the score.

The first movement confirms this faith in the earliest bars followed by a fervent allegro recorded with a wide range which is never allowed to become unwieldy.

The dainty accuracy of the second movement is most alluring although some critics might find it a little facile. The Finale, the famous Lutheran hymn, is a fine technical achievement in its variety and ceaseless invention. The whole symphony is beautifully played and the sound, which I think must surely have been reprocessed, is excellent.

The Fourth Symphony (the Italian) is still popular and appears frequently on contemporary programs. Its first movement is invigorating, the playing beyond praise. The second is sometimes called the Pilgrims' March and at the pace taken here would have needed a brisk step. Marked andante con moto it is much more like a moderato. The third movement resembles a northern landler rather than a southern minuet. Nothing Italian here. But the Finale atones with a prestissimo Salterello, a Neapolitan dance much like a Tarantella.

The gay cover painting by Mendelssohn himself is pleasing if not very original. I strongly recommend the whole production. (J.R.)

JANACEK

Sinfonietta. Taras Bulba, Rhapsody for Orchestra. Vienna Philharmonic Orchestra conducted by Sir Charles Mackerras. Decca Digital Disc SXDL 7519.

As Beecham was to Delius and Sargent to Elgar and Boult is to Vaughan Williams, Mackerras is, at any rate to British ears, to Janacek. Mackerras spent the last years of his higher musical training in Czechoslovakia where he learned the language and the nature of the Moravian people well enough to appreciate the subtle effect of this tongue on Janacek's music.

His present recording is superior to that he made some years ago. Mackerras now uses the composer's original score though if he had to get it from Janacek's almost indecipherable manuscript I pity him. The sound is therefore often much different from the first recorded version, first because of the unaltered music, and secondly because this one is digitally recorded.

The first "fanfare" movement comes off very well except for slight over-resonance in the drums until later in the movement when the trumpet theme is developed. Its unique style, right outside the general trend of central European music, is apparent in the first bar. The second movement is in complete contrast with its odd juxtaposition of themes. But then, under Mackerras, everything is contrasted in this powerful drive of a performance. Next comes the third movement, taken almost caressingly, despite its vast changes of tempos.

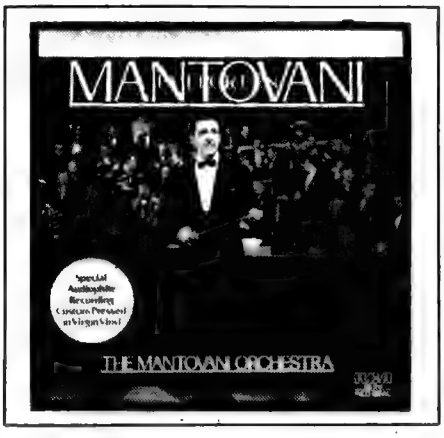
The ostinatos of the fourth movement give it a scherzo-like quality, yet in a way unlike it since Mackerras seems to be looking forward to a later period of musical development. In the Finale he brings everything together with brilliant panache. Strongly recommended.

I am equally delighted with Taras Bulba where Mackerras avoids a Sibelius-like desolate effect with the opening cor anglais solo by careful lyrical shaping of the line. The ensemble in the second movement is superb with the violent revengeful repeated figures snapping as if they had teeth. The Finale is right up to the standard of the previous ones and reflects great credit on all concerned with the production, orchestra, engineer and still more importantly conductor who demonstrates how he can bring the fiercest emotion to the music without sacrifice of lyricism. (J.R.)

MANTOVANI

EVERGREEN MANTOVANI. The Mantovani Orchestra. RCA Silver Sound Series. Digitally mastered stereo SSL-0004.

Everything was right for Mantovani in the '50s and early '60s, with a constant flow of rich melodies to match his singing strings, from composers like Gershwin, Kern, Berlin and Loesser.



But, say the jacket notes, the late '60s and '70s saw the entrenchment of rock 'n roll and a shrinking of the melodic maestro's options towards the "three B's" of popular music – The Beatles, Bacharach and Bossa Nova.

But things have changed yet again in the '80s, with renewed demand for melodic popular music and the emergence of high rating "good music" radio stations.

And now, of course, Mantovani also has access to digital technology and a better chance to cope with the "edginess" that can so easily mar the recording and reproduction of massed strings. This particular recording was made on 3M digital equipment, in Winnipeg, Canada, and custom pressed in virgin vinyl. There is certainly no surface noise and the sound quality is good but the modest dynamics of this kind of music provides no sonic drama to exploit the potential of the system.

But, if you're overdue for another infusion of the Mantovani sound, this one will give 12 tracks and a playing time of about 38 minutes: Evergreen (the title track) – Can't Smile Without You – Mull Of Kintyre – What I Did For Love – Just The Way You Are – Annie's Song – I Write The Songs – You Make Me Feel Brand New – Nobody Does It Better – Let It Be Me – Plaisir d'amour – Weekend In New England.

Okay for pleasant listening but not a digital demonstration disc. (W.N.W.)

SYDNEY SYMPHONY ORCHESTRA

Conductor Patrick Thomas in a concert of short pieces by Offenbach, Delius, Schmidt, Weber, Haydn, Elgar, Scarlatti, Berlioz and Goossens. Made by the ABC for Philips, 410377-1.

Here's a local recording made by the ABC for Philips. The program consists of what Beecham would have called "Lollypops" as he referred to a similar collection of his own he made many years ago. The orchestra is the Sydney Symphony under talented conductor Patrick Thomas, the sound, indeed the production, under the supervision of that reliable expert Eric Clapham.

And very good it is. In all they play nine shortish pieces, with a very few exceptions very well indeed. Let's get rid of the gripes first.

I thought the end of the Delius Marche Caprice a trifle sharp in pitch. I thought the dynamic range so wide that at normal levels the softer parts of Weber's Clarinet Concerto are almost inaudible. I would have liked a very slightly lighter touch in the Good Humoured Ladies' Suite. At its present weight it tends ever so slightly to worthiness though the playing is never less than first class. I also thought some parts of Caractacus could have had a touch more brass.

Now for the very many good points. The band plays with exemplary accuracy, brilliant attack and release, good tone and unquestionable obedience to the conductor's many expressive turns of interpretations. These are everywhere apparent. A Berlioz Reverie and Caprice gets full treatment and a premier recording of Haydn's Overture to The Fisherwoman adds a note of respectability to the whole good-natured exercise. The various soloists all acquit themselves splendidly.

And Eugene Goossens who must always be remembered as a most efficient musician finishes the whole excellent production with a set of variations, on a French folksong. It's all a credit to our resources. (J.R.)

COPLAND

Fanfare for the Common Man, Rodeo. Louis Lane conducting the Atlanta Symphony Orchestra. Digitally mastered stereo, Telarc DG-10078. [From P. C. Stereo Pty Ltd, PO Box 272, Mount Gravatt, Qld 4122. Phone (07) 343 1612.]

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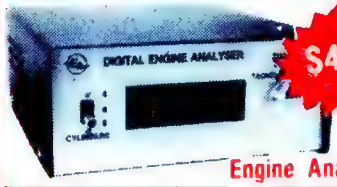

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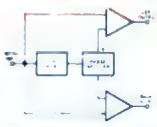

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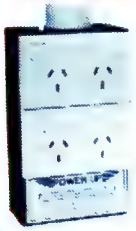

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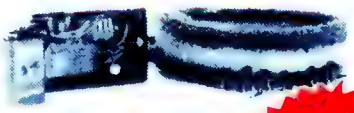

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side 1 track 1, is a huge transient from the drums, which thunders and shimmers in a way that cannot but fail to catch the ear of a hifi devotee; it's just so hard and clean. And "clean" is the adjective that best describes the whole of this recording, even though much of remaining sound is quite restrained, as throughout the Appalachian Spring Suite.

Born in 1900, Aaron Copland has frequently been described as the "dean of American composers" although Leonard Bernstein, who came to know him well, prefers to think of him as a father figure of American music.

"Aaron," he said "has a particular genius for taking raw elements – natural resources, so to speak – and making them into a serious language of his own.

"He's not partisan by nature. The one thing he's been partisan about all his life is the cause of American music. Aaron was always in the forefront of that parade."

In his generous jacket notes on the present recording, Steven Ledbetter points out that, until the middle of the last century, American music was synonymous with hymn tunes, theatrical songs and popular ditties, music for the home, for dancing and marching – all of it far removed from accepted "culture".

It was into that setting that Copland came.

The first item, "Fanfare for the Common Man", was composed during World War Ii in response toa commission from Eugene Goossens, then conductor of the Cincinnati Symphony Orchestra. It has proved the most enduring of the particular group of 10 fanfares, reviewed some time ago in these columns.

"Rodeo", composed as a ballet in 1942, was intended as a successor to Copland's popular "Billy the Kid" but it is most commonly heard nowadays, as here, as a four-part suite.

City bred, Copland borrowed from the traditions of the wild west for the four segments: "Buckaroo Holiday" with melodies from two popular songs; "Corral Nocturne", original atmospheric music; "Saturday Night Waltz", a touch of the genteel out west; "Hoe-Down", inspired by the square dance tune "Bonyparte".

"Appalachian Spring" (Suite) is Copland's own orchestral rearrangement of his popular ballet of the same name, originally scored for 13-piece chamber group. Listening again to the latter version on a 1978 3M digital recording, I tended to prefer it for the more open structure of the smaller group, but the fact remains that the Suite was acclaimed in 1945 as Copland's finest composition, being awarded the Pulitzer Prize for that year and the Award of the Music Critics Circle for the 1944/5 season.

Some may feel that the new recording has too much of the concert hall and not enough of the simple quaker farmhouse in the hills of Pennsylvania, where the original ballet was supposed to be set. But perhaps I quibble and, as I remarked earlier, the digitally mastered sound is very clean and, in itself, a reward for the technically minded listener. (W.N.W.)

BERLIOZ

Symphonie Fantastique. The Utah Symphony Orchestra conducted by Varujan Kojian. Reference Recordings 2-record set. Distributed by M. R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598.

This two-record set is a little unusual in that it has been mastered to run at 45rpm which means that the symphony occupies three of the four sides. Rather than leave the fourth side blank (or with a 15-minute piece from Berlioz or some other composer) the recording company have elected to make it an extra copy of side three. The idea behind this is that audio enthusiasts will probably want to play side three more often and will thus welcome the extra copy. Hmm.

The reason for recording at 45rpm is to enable a larger dynamic range than would otherwise be possible using the standard 33rpm speed. In fact the jacket notes warn about the dynamic range and specifically about side three which contains the "March to the Scaffold" and "Dream of a Witches' Sabbath".

My experience was that, provided you do not turn up the quiet passages to the point where surface noise becomes noticeable, the dynamic range was handled without any problems by my system. But while I noted that surface noise is not a problem at usable volume control settings, tape hiss is noticeable if you are reasonably keen-eared.

Overall the dynamic range of the record is impressive but I found the balance between bass and treble too weighted towards the bass end of the spectrum. Violins lacked bite and trumpets lacked blare. I was a little disappointed in the performance of the orchestra too. Compared with other versions of the Fantastic Symphony that I have this one is too ponderous and slow. The bursts of frenzied passion and fury in the first movement, for example, are just not frenzied enough, in my opinion. (L.D.S.)

PICTURE OF THE YEAR

CAREFUL HE MIGHT HEAR YOU. Original film soundtrack album composed and conducted by Ray Cook. Stereo, Syme Entertainment Pty Ltd, L-38092. Distributed by Festival.

Adapted from a novel by Sumner Locke Eliot, the new Australian film "Careful He Might Hear You" is a joint production of the Syme organisation and the NSW Film Corporation. It was nominated for 13 of the 14 Australian Film Institute awards – indeed in all the categories for which it was eligible. It carried off eight of them, including the coveted Best Australian Picture of the Year.

Music for the film was composed by Ray Cook, Australian born and educated at the Adelaide High School, the Adelaide Conservatorium of Music and the Sydney Conservatorium. Music has been his life ever since.

Following early but valuable experience with the Philip Street Theatre in Sydney and the Australian Broadcasting Commission (1956-1960), Ray Cook did the rounds of the main London theatres as Pianist, Assistant Musical Director, and Musical Director

for a variety of major productions, directed productions in France, America, Canada and Australia, becoming involved also in ballet and TV drama production.

The film is about a 6-year-old boy "PS" (Nicholas Gledhill) who, following the death of his mother, becomes the victim of an emotional tug-o-war between two of his aunts (Wendy Hughes and Robyn Nevin).

It's a poignant story — or so I understand from those who have seen it — and Ray Cook's music has about it an introspective quality that permeates all the tracks, the titles of which summarise the film. I quote those on side 1:

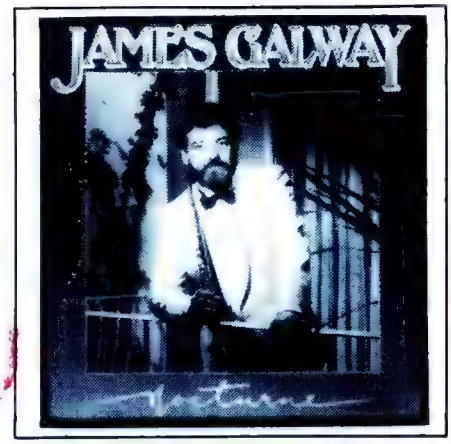
Main Theme — PS Overhears Lila and George — PS and Lila — The Meeting — Vanessa's Mansion — PS Saying His Prayers — The Cricket Match — PS' Piano Practice — PS Meets His Father. Six more tracks follow on side 2.

As with most soundtrack albums, its greatest appeal will probably be to those who have enjoyed the film but, even outside that context, it can provide a pleasant orchestral background to everyday activities.

Recorded in the AAV Studios in Melbourne, the sound quality is well up to normal standards. (W.N.W.)

TURN OFF TV AND RELAX!

NOCTURNE. James Galway, flute, with the National Philharmonic Orchestra conducted by David Measham. Stereo, RCA Red Seal ARL1-4810.



Recorded in February 1983, at the CBS Studios in London, this new James Galway release is made to order for relaxation, whether you choose to switch off and listen actively, or simply to switch off and let the sound create its own atmosphere.

You may have heard track 1, "Clare de Lune", so many times that it has become repetitive but, somehow, James Galway seems always to come up with arrangements and a refinement in presentation that imparts new interest to the classical evergreens that help make up this album:

Clare de Lune (Debussy); Nocturne in E-Flat (Chopin); Dreamers (Hamlisch); Pan and the Birds (Mouqet); Meditation from "Thais" (Massenet); Berceuse from the "Firebird" (Stravinsky); Berceuse from "Dolly" Suite (Faure); En Bateau from "Petite Suite" (Debussy); Nocturne (Lili Boulanger); Nocturne No 5 in B-Flat (Field); Consolation No 3 in D-Flat (Liszt); Morning from "Peer Gynt" Suite (Grieg).

No statements are made on the jacket as to the technique or quality of the recording but the uniform level of these arrangements presents no special problems, anyway. Sufficient to say that the sound and the surface are both very clean, with no hint of noise or distortion anywhere.

It's a delightful recording, with a wide potential appeal. (W.N.W.)

Sony PCM Adapter

. . . continued from p39

14 and 16-bit digital systems and are much better than comparable analog systems. The rapid increase in distortion above 0dB is caused by the system running out of bits with which to encode the signal. This situation actually occurs at +0.8dB – the same level at which the overload warning is activated. Because levels above +0.8dB cannot be encoded, they are simply clipped off, resulting in rapid increases in distortion with further increases in signal level.

As expected, wow and flutter in the PCM-701ES output signal was too low to measure with out test equipment and for all intents and purposes may be considered zero.

Since the PCM-701ES must be teamed with a VCR of some sort, the ease with which the VCR tape transport controls work determines to a large extent the ease of using the whole system. For our review Sony supplied us with an SL-C9AS VCR which worked extremely well with the PCM-701ES.

During our review the PCM-701ES worked very well providing tapes which were indistinguishable from the original program source. One dropout did occur during playback of a tape, however since this was once only (it did not occur on subsequent playbacks) we can assume that it was due to a transient piece of dirt or oxide on the VCR heads. This did point up the need to keep the VCR heads clean since operation of the muting circuitry during dropouts puts quite a hole in the music and is much more noticeable than say a scratch in an analog system.

The PCM-701ES is available from hifi retailers who stock Sony equipment and carries a suggested retail price of $1349. Further information may be obtained from a Sony retailer or from the head office of Sony (Australia) Pty Ltd at 453-463 Kent St, Sydney 2000. (J.S.)

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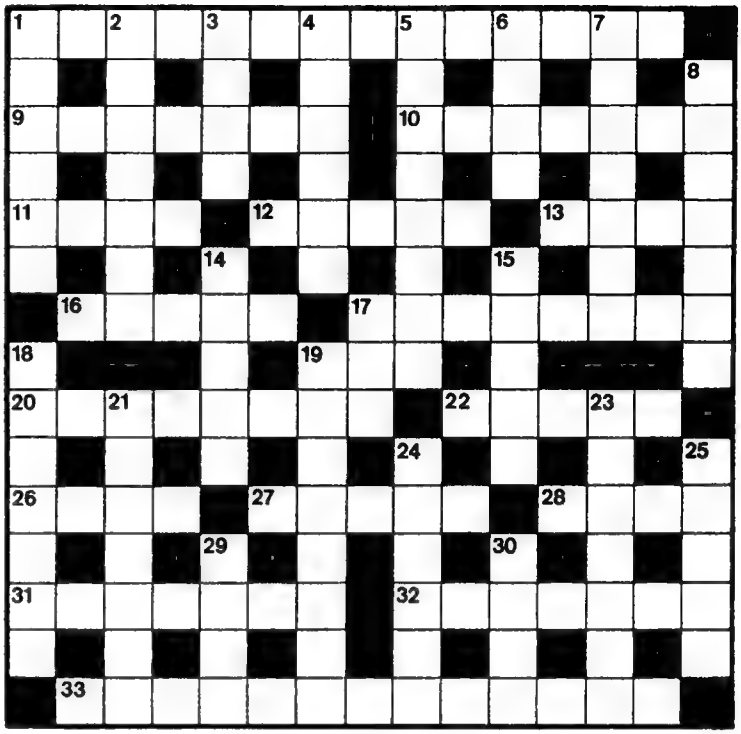

ACROSS

1. These are used in all solid-state devices. (14)
9. Having a phase difference. (7)
10. Scientist famous for his electromagnetic work. (7)
11. Name of an early passive satellite. (4)
12. Magnetic unit. (5)
13. Metal sheeting. (4)
16. Name of a dark space in gas-discharge tubes. (5)
17. Likely place to find an electronic counter salesman? (6, 2)
19. Spectral hue. (3)
20. Fast method of data transfer. (8)
22. Said of resistors with linear relationship between voltage and current. (5)
26. Visible electric discharges. (4)
27. Relating to charged atoms. (5)
28. One of a TV's guns. (4)
31. Electrons released from a cathode. (7)
32. Starting impulse. (7)
33. Rechargeable device. (9, 4)

DOWN

1. Joining alloy. (6)
2. Units of resistance. (7)
3. Processed piece of a semiconductor. (4)
4. What a metal-detector enthusiast hopes to find. (6)
5. Possible state of a semiconductor hole. (8)
6. Prefix meaning a factor of 10^{12}. (4)
7. Transmitted an RF signal. (7)
8. Graphical marks. (1-1, 5)
14. Unit of energy. (5)
15. What causes photoemission? (5)
17. Unit measuring ratio of voltage, etc. (3)
18. Electro-acoustic device. (7)
19. Made a reproducible store of data. (8)
21. Pick up radio signals. (7)
23. Said of unlawful transmissions. (7)
24. Electronic network. (6)
25. Unit of inductance. (5)
29. Prefix meaning a millionth of pico. (4)
30. Substance used as dry cell electrode. (4)

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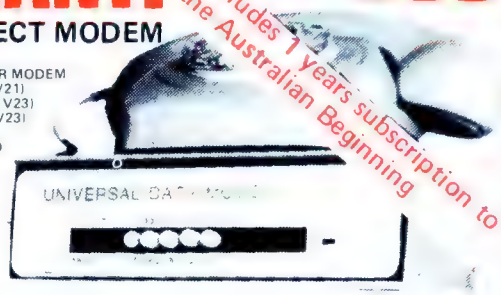

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Cat. XE-1205	Printer Cable Interface	$49.95

MICROBEE

KITS–KITS–KITS–KITS–KITS–KITS–KITS–

ETI 733 RTTY Convertor. Ref ETI April 1983. This simple project allows you to hook up your MicroBee to a HF receiver and print radio teletype messages on a monitor screen. Listen to world news for FREE!!
Cat. KE 4654 — ONLY $17.95

ETI 649 MicroBee Light Pen. Ref ETI August 1983. This simple, low cost device plugs into the Bee's 8 bit port. The "pen" gives you an entry into the world of light pens and interactive software.
Cat. KE 4656 — SHORTFORM $19.50
SPECIAL PROBE CASE TO SUIT (as specified in ETI article) Cat HB-6400 — $19.95

ETI 668 MicroBee EPROM Programmer. Ref ETI February 1983. This simple, low cost EPROM programmer just plugs into the Bee's I/O port and enables you to save programs in any of the 5 different common EPROMs available (2716, 2532, 2732, 2732A, 2764). Kit comes complete with 'Personality' plug and all IC sockets.
Cat. KE 4650 — $39.95

Parallel Interface Kit for the MicroBee. Includes 15 pin 'D' plug – add $15.00 if Centronics plug required.
Cat. KE 7017 — $15.00

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OFTWARE & PERIPHERALS

DISASSEMBLER By Dreamcards
Some may "Not another Disassembler". But this one has a difference. It allows you to set out where the data fields are so the computer is saving time, not rying to disassemble data. A program you shouldn't be without.
Cat. XE-6915 $15.00

CHEAPIE By Dreamcards
Two top quality programs for the price of one. The best Hangman we've seen yet on side A and a superb version of Battleship on side B. Both have excellent graphics.
Cat. XE 6920 $15.00

CANNIBALS AND MISSIONARIES
The old logic problem game of transferring 3 Cannibals and 3 Missionaries from one side of a river to the other in a boat that holds two. If there are more Cannibals than Missionaries on either side at any time the Cannibals revert to their favourite form of feeding.
Cat. XE-6925 $14.95

COMPOSER BEE
This is a very well written program for music. This program allows you to compose, play, edit, transpose as well as being able to load and save your music. A program that has been a long time in the writing and well worth buying.
Cat. XE-6930 $22.50

WORD ADVENTURE
A program with very good graphics using little characters to entice the user to think what word is either a synonym, antonym or homonym of the word they are showing. Everytime you get it wrong you are given more clues. After the clues run out you must face the Dragon when you must spell the word he is holding correctly before you.
Cat. XE 6935 $14.95

PONTOON
A quality fast moving card game where up to 6 players can play against the computer who is banker.
Cat. XE-6940 $14.95

MUSIC – B – MYTEK
MusicB is a music Composer/Editor that lets you create and save music and sound effects with a flexibility that makes chopsticks of the Basic PLAY command. MusicB is a great way to learn and play music! Comprehensive instructions are included.
Cat. XE 7010 $20.00

TRSBEE – MYTEK
TRSBEE is a package of three programs that loads TRS-80 Model 1 and 3 program tapes into the MicroBee without any additional hardware. Although some program editing will still be required prior to their running, the majority of program typing time is saved by TRSBEE. The first program loads TRS-80 BASIC programs into MicroWorld BASIC. Most prgrams may then be edited and run. The second program in the package loads any TRS-80 machine code file into MicroBee memory. The third program loads TRS-80 assembler files into the MicroBee EDITOR/ASSEMBLER. Any TRS-80 Model 1 or 3 tape may be loaded. TRSBEE opens up a whole new world of possible software on your MicroBee!
Cat. XE 7005 $30.00

HOUSEHOLD REGISTER
This program will simplify the task of determing the value of your home's contents for insurance purposes, as well as providing descriptions of all listed items in the event of their loss or destruction. Effects are catalogued by name, description and value. Nine separate rooms are provided, and up to 28 items may be listed in each.
Cat. XE 7000 $15.95

STAT PACK – STATISTICS
This program is a general purpose graph plotting, linear regression, line of best fit and correlation program. It features a t-test of significance for the correlation coefficient and, if no evidence of correlation is found, a determination of minimum sample size is performed.
Cat. XE 6999 $14.95

BASIC TUTORIAL
Is a super teaching aid for any classroom. Basic Tutorial is a set of 9 interactive exercises designed for teaching Basic to the computer novice. No previous knowledge is assumed. Basic Tutorial uses a unique double screen technique to display both the normal computer output and the tutorial exercises at the one time. This allows the student to use the MicroBee in the normal way, while the tutorial instructions appear in the lower half of the screen.
Cat. XE 6860 $20.00

MACHINE CODE TUTORIAL – MYTEK
Consists of 8 interactive exercises designed for teaching machine code programming and related topics as they apply to the MicroBee computer. Only a general knowledge of the BASIC language is assumed. Machine Code Tutorial is designed to bridge the gap bewteen BASIC programming and being able to understand and use typical Z80 manuals.
Cat. XE 6855 $25.00

BUDGET – SPREADSHEET
This program is designed to speed up and simplify the task of framing a usable financial budget. Applications range from personal or household to small business finances. A quality program.
Cat. XE 6850 $15.95

DECODE
Basic decoder and listing formatter
This programme will be an invaluable aid to any one taking first steps in understanding machine code or wants to expand their library of proven machine code routines. Decode will (a) print imbedded machine code routines fully and accurately (b) print all unprintable characters (c) provide a clearer, easier to read listing and send all output to a printer if so required. ED ASM is not required.
Cat. XE 6765 $15.95

DATABEE
This program is a well written data base management system that utilised the MicroBee to its fullest to provide a Data Management System similar to those found on larger and more expensive systems. This comes complete with large bound manual.
Cat. XE 6945 $19.95

ASTEROIDS PLUS – MYTEK
Asteroids Plus is one of the finest high resolution graphic arcade games available for the MicroBee computer. It features 3-D point by point resolution graphics, shields, sound effects, intelligent objects, guided missiles, black holes and a score board. If you enjoy playing computer games, you will be captivated by Asteroids Plus.
Cat. XE 6297 $22.50

BEEZ 80 – MYTEK
This secret code disassembler will disassemble any code sequence. Nothing is illegal. It will allow you to program with codes that no other disassembler can decipher!
Cat. XE 6298 $20.00

SPACE INVADERS
One of the most popular programmes ever released. This version was written especially for the MicroBee.
Cat. XE 6030 $14.95

FORTH
A new language for the MicroBee. Comes complete with interpreter on one side of the tape and supporting programs on the other side. As well as this it includes a very well written, bound manual.
Cat. XE 6965 $45.00

PSYCHOTEC By Dreamcards
Psychotec provides a striking example of artificial intelligence, allowing a dialogue in English between computer and operator, the computer playing the role of psychiatrist and the operator being a "patient" on the couch. Leaves other "similar" types for dead.
Cat. XE 6875 $15.95

MERLIN By Dreamcards
Merlin is a 32K adventure set in England during the dark ages. Your task is to search through the dark forest inhabited by robbers, outlaws and creatures with awesome magic powers to find a legendary sword. An excellent adventure.
Cat. XE 6870 $25.00

PROGRAMMING HINTS
Consists of a collection of modules which you may use to improve your own BASIC programs. They are all linked together under a menu driven display which allows you to RUN or LIST each module to see how they work.
Cat. XE 6895 $14.95

LOG – GENERAL PURPOSE INDEX
This program is designed to suit a wide range of records where indexing (and later searching) can be on one or two words, or on a string of up to 15 characters. Each record consists of its index heading, plus up to 12 lines of text. Each line can contain up to 41 characters.
Cat. XE 6890 $15.95

MINE DROP
You are a tank running around a maze gathering all the supplies you can. It sounds easy, but you have a guided missile hot on your trail. Your only defence is a remote controlled mine which you drop and explode at will. A very fast joystick or key controlled game.
Cat. XE 6960 $14.95

PENETRATOR
A low resolution graphic version of the popular game "Scrambler". You must defeat the rockets and bomb the radars in an effort to get to the next stage which is even harder. This game can be either controlled by a Joystick or by keys Being in Lores graphics it is a very fast game. If you are bored with the same land pattern you can devise your own
Cat. XE 6955 $19.95

SPACE PATROL
A lot like Penetrator but in high resolution graphics. You must battle your way through the various stages where at the last stage you have four chances of blowing up a neutron bomb shelter. If you are successful, the next round is a lot harder.
Cat. XE 6950 $16.95

METEOR RESCUE – MYTEK
Your mission is to rescue stranded astronauts. You are the commander of the Landing Module docked in space with the mother ship. It is your responsibility to guide the landing module through a meteor field, down to the surface of the planet, to land safely on a landing pad. An astronaut will then run to your landing module and you will blast off. You must use your lasers if necessary and dock with the mother ship again. A total of six astronauts must be shuffled to the mother ship.
Cat. XE 7020 $17.50

CORVILLE CASTLE
Corville Castle is an adventure which will take you to a far away place of mystic castles, fierce monsters and evil warlocks. You must enter the warlocks castle and find some dark secret which will help you to destroy the warlock. But remember, you only have until dusk.
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DEFENDER
for the MicroBee Computer

Fast Furious Action Game

DEFENDER – FROM MYTEK
This long awaited program is finally available. Defender needs no introduction. The Defender arcade game is one of the most popular ever produced and the Mytek version is brilliant, a rival for Asteroids Plus.
Cat. XE 7036 $22.50

DESTROYER
You are the UFO and you must destroy the enemy city buildings before you can land. You have no control over the UFO except for the three bombs on every pass you make over the city. But beware the UFO gets lower with every pass. Good graphics and sound.
Cat. XE 7048 $14.95

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This program is another in the series of Physics simulations. The first part is a tutorial and the second is a simulation of the experiment
Cat. XE 7049 $14.95

BACKGAMMON – FROM MYTEK
This game conforms exactly to that set down in the official rules of the International Backgammon Association, including the rules of doubling and scoring.
Cat. XE 7050 $17.50

POOLS AND LOTTO
Two programs to help make life easier for the Pools and Lotto enthusiast. The first program chooses your numbers for the week and the second program allows you to input your numbers into a program and when Lotto night arrives you can input the winning numbers and the computer will check your Lotto for you
Cat. XE 7045 $14.95

WONDER WORDS
This program allows you to input 20 words and the computer will create a Wonder Word puzzle. This can be either sent to a printer or solved on the screen or let the computer solve it. Just the program for Wonder Word enthusiasts.
Cat. XE 7046 $14.95

GEO TECH DRAWING
This is the first tape in a series to assist students in grasping the fundamentals of geometric and technical drawing. It uses good graphics with excellent explanations
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Micronews

New portable is a world beater

The most significant new computer of 1983 would have to be the Dulmont Magnum. With a full 16-bit processor and up to 256K bytes of RAM in a portable, battery-powered package the Magnum is an exceptional product by world standards – designed and manufactured in Australia.

President Computers will be distributing the Magnum through their 187 outlets nationwide. Managing director Tom Cooper goes so far as to say that the Magnum will establish Australia as the leader in the portable computer market. Certainly the development and production of the machine is a landmark for the Australian computer industry.

The Magnum computer is a "briefcase portable" measuring 305 × 280 × 50mm (W × D × H) when the LCD screen is folded down over the keyboard. The processor is the Intel 80186, an upward-compatible enhancement of the 8086 with a two-channel DMA controller, three 16-bit timers, interrupt controller, bus controller and clock circuit on the chip.

Essentially the 80186 provides significantly improved performance over the 8088 and at the same time reduces the manufacturing costs of the system.

The liquid crystal display of the Magnum is mounted in the front half of the top cover, which can be locked in one of a range of positions to allow the best viewing angle. The screen displays eight lines of 80 characters each, with fully-formed upper and lowercase characters.

In conjunction with the compact, typewriter-style keyboard the LCD screen makes the Dulmont Magnum a true "go anywhere" computer. Twelve user-definable function keys and a "Help" key integrated with the software available for the Magnum, allow a "menu-driven" approach which is certain to appeal to new users.

The operating system of the Magnum is MS-DOS 2.0, and various applications programs are contained in 128K bytes of internal Read Only Memory. As standard the Magnum comes with word processing software, an electronic spreadsheet program, a planner/diary based on the internal clock and calendar of the machine, and Basic-86 for those who wish to write their own programs.

Optionally available will be an accounting package and an engineering planning and calculation package, plus other software running under MS-DOS. Two 128K byte ROM packs can also be plugged above the keyboard, allowing the on-board software to be further expanded.

Peripherals and expansion capacity have not been ignored. Two RS-232C serial ports and a Centronics parallel printer port are included as standard, together with a video output which supplements the LCD screen with an 80 × 25 line display on a video monitor. IBM-PC compatible dual double-sided 13cm disk drives will be available in an expansion interface which also includes an additional 256K bytes of RAM and a power supply for the system.

Another expansion box is under development with an eight slot motherboard which will take IBM-PC expansion boards. The intention is that anything which can be added to the PC will be compatible with the Magnum hardware.

Manufacturer of the Magnum, Dulmont, is jointly owned by Dulmision, a leading Australian supplier of electrical power line fittings, and Tramont, a subsidiary of the Belgian Tractionel group. Dulmont was formed in May this year when it became clear that the Magnum project would require substantial funding and international backing if it was to be marketed in a manner suited to the unique new concept.

Printronics did the circuit boards, chips came from overseas, and research and development was initially supported by a $350,000 grant from the Department of Science and Technology.

As a result of these combined efforts the Magnum is set to make a considerable impact on the portable computer market, both in Australia and overseas.

80 Micro programs on cassette

LOAD 80 is a "magazine on cassette" containing the programs which appear in each monthly issue of the US "80 Micro" magazine for the TRS-80 Model 1, Model 111 and System 80 computers.

A companion cassette, "COLOR LOAD 80", appears quarterly and contains Basic and machine code programs for the TRS-80 Color Computer. Each cassette contains on average 20 ready to run programs.

LOAD 80 and COLOR LOAD 80 cover new screen routines, games, business programs, utilities and educational programs. Both are now available in Australia at a recommended retail price of $19.95 from Australia Computer Software, PO Box 450, Malvern, Vic, 3144. Phone (03) 20 4947.

SOME COMPUTERS ARE BETTER THAN OTHERS

	SPECTRAVIDEO SV 328	SPECTRAVIDEO SV 318	APPLE II E	ATARI 800	COMMODORE 64	BBC MODEL B	DRAGON 32	SPECTRUM
COMPUTING POWER FEATURES								
BUILT-IN ROM	48K	32K	16K	10K	20K	16K	16K	16K
EXPANDABLE TO	96K	96K	N/A	42K	N/A	64K	N/A	N/A
BUILT-IN EXTENDED MICROSOFT® BASIC	YES	YES	YES	ADDITIONAL COST	NO	NO	YES	NO
BUILT-IN RAM	80K*	32K***	64K	48K	64K	32K	32K	16K
EXPANDABLE TO	256K**	256K**	64K	NO	N/A	32K	64K	48K
KEYBOARD FEATURES								
NUMBER OF KEYS	87	71	63	61	66	73	53	40
USER DEFINE FUNCTIONS	10	NO	N/A	4	8	10	N/A	N/A
SPECIAL WORD PROCESSING	YES	YES	NO	NO	NO	NO	NO	NO
GENERATED GRAPHICS (FROM KEYBOARD)	YES	YES	NO	YES	YES	YES	YES	YES
UPPER/LOWER CASE	YES	YES	YES	YES	YES	YES	YES	YES
GAME/AUDIO FEATURES								
SEPARATE CARTRIDGE SLOTS	YES	YES	NO	YES	NO	NO	YES	NO
BUILT-IN JOYSTICK	NO	YES	NO	NO	NO	NO	NO	NO
COLORS	16	16	15	128	16	16	9	8
RESOLUTION (PIXELS)	256x192	256x192	280x160	320x192	320x200	256x640	256x192	256x192
SPRITES	32	32	N/A	4	8	?	16	?
SOUND CHANNELS	3	3	1	4	3	1	3	?
OCTAVES PER CHANNEL	8	8	4	4	9	3	5	3
A.D.S.R. ENVELOPE	YES	YES	NO	NO	YES	YES	NO	NO
PERIPHERAL SPECIFICATIONS								
CASSETTE	2 CHANNEL	2 CHANNEL	1 CHANNEL	2 CHANNEL	1 CHANNEL	2 CHANNEL	?	?
AUDIO I/O	YES	YES	NO	YES	NO	?	?	?
BUILT IN MIC	YES	YES	NO	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY	256K	256K	143K	92K	170K	100K	?	?
(LOW PROFILE)	YES	YES	NO	NO	NO	NO	NO	NO
CP/M® COMPATIBILITY (Standard 80 column								
CP/M® 22 programs)	YES	YES	NO****	NO	NO*****	YES	NO	NO
CP/M /*	YES	YES	NO	NO	NO	NO	NO	NO

Specifications are subject to change without prior notice.

Microsoft is a registered trademark of Microsoft Corporation
CP/M is a registered trademark of Digital Research, Inc

* 64K user addressable plus 16K graphic support
** 240K user addressable plus 16K graphic support
*** 16K user addressable plus 16K graphic support
**** Apple II can accept modified 40 or 80 Column CP/M
***** Commodore 64 accepts 40 column CP/M
? Data not available

OURS IS MUCH BETTER

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The SV-318 isn't just more expandable. It's much more expandable. Unlike many other so-called computer systems, all our important peripherals are available at once. That means you can get almost full usage out of your SV-318 from the day you buy it. With the Super Expander, Data Cassette, Floppy Disk Drive, Dot Matrix Printer, Graphic Tablet and SV-800 Series Expansion Cartridges, there's almost no end to the work you can do. Or to the fun you can have. The SV-318 is well designed to interface with new options as they become available, too. All this adds up to a computer you'll grow into, not out of.

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with the optional SV-105 Graphic Tablet you can draw pictures, graphs, charts and other visual images on your TV screen. Considering what you get for what little you pay, the SV-318 is once again the only logical choice

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Micronews

IBM PC to be made in Australia

IBM has announced plans to produce its Personal Computer in Australia. A plant in Wangaratta, 220km north-east of Melbourne will be converted for PC manufacture.

Since the IBM PC was released late in 1981 it has taken over 25% of the world market for personal computers, with estimated sales of over one million units. Sales in Australia, though, have not been up to expectations and this may be one reason behind the decision to set up manufacturing here.

Wangaratta will join Boca Raton, Florida, and Greenock, Scotland as PC production centres and will be used to supply markets in Australia, New Zealand and South-East Asia.

Announcing the plan, Mr Brian Finn, managing director of IBM Australia, said that local manufacturers could supply about 25% of the components of the Personal Computer. IBM has stated that it will purchase an estimated $27 million worth of computer components from Australian manufacturers over the first five years of the plant's operation.

Along with hardware manufacture IBM will also set up a software centre in NSW which will acquire products from local industry and market them through IBM's worldwide distribution channels.

Eventually, according to Mr Finn, the company intends to transfer production of Personal Computer software from the United States to Australia.

In the United States IBM has recently abolished a clause in its standard software acquisition contract which limited royalties to program authors to $US100,000. The change was in reponse to complaints from authors that IBM's terms for software acquisition compared unfavourably with those of other companies.

2001st Sirius computer delivery

Two thousand Sirius computers have been sold in Australia since its introduction in July 1982, and to mark the occasion Barson Computers recently presented the 2001st to the Shell Company of Australia.

According to Julian Barson, "wide acceptance by large Australian corporations has been instrumental in establishing Sirius as probably the top selling microcomputer in its category". Monthly sales of the Sirius computer are around 230, with the larger capacity 2.4MB and 10MB hard disk systems representing 70% of the total.

For further information on the Sirius machine contact Mr J. Barson, Barson Computers, (03) 419 3033 or Bill Saunders, BS Microcomp, (03) 614 1433.

Micro colour matching system

Microcomputers are making an impact in many fields, but entirely new applications are rare. One such, however, is a new colour measurement system introduced by Instrumental Colour Systems.

Based on a Z80A microprocessor system, the desk-top unit can store and manipulate colour data for a range of colour measurement and control applications. With 64K of RAM and twin dual minifloppy disk drives, the computer can also be used for many standard business applications when not at work in the laboratory or quality control department.

Called the Micromatch 2000, the system incorporates some of the most popular features of larger units made by Instrumental Colour Systems Ltd of England, who specialise in colour control and colour matching applications. Colour sensing is by means of a high precision spectrophotometer and data on up to 1000 colour standards can be stored and processed.

Applications of the Micromatch are seen in the textile, clothing, printing, paint and plastic industries and some of the more unusual tasks undertaken so far include matching the frames of sunglasses, cocoa blending, and ensuring that Army khakis are indeed uniform.

The Micromatch is being distributed in Australia and New Zealand by Hardie Trading Ltd.

LORLIN supa-switches from C&K

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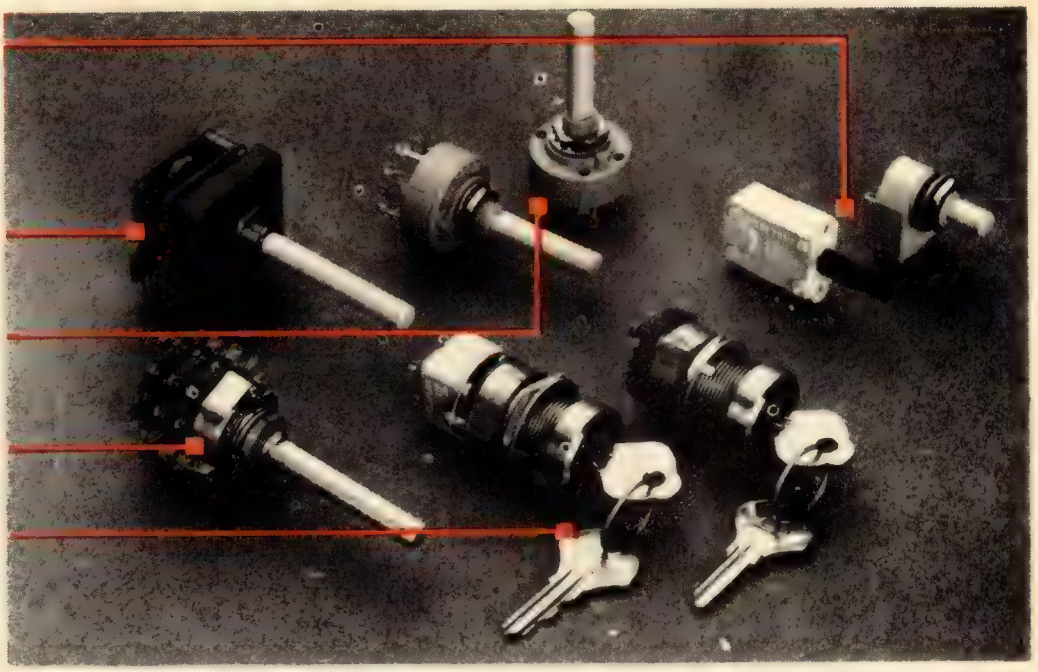
Types KMS and KRA — Random or common keys, key trapping facility. Mains switch at 4A, 250V, 80A. surge or RA rotary wafer, multi position.



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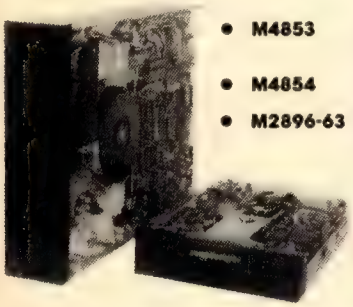
A most important feature of the drives is the direct drive brushless D.C. motor that eliminates A.C. power requirement and belt drive problems.



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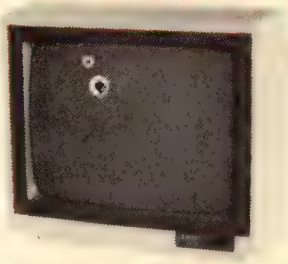

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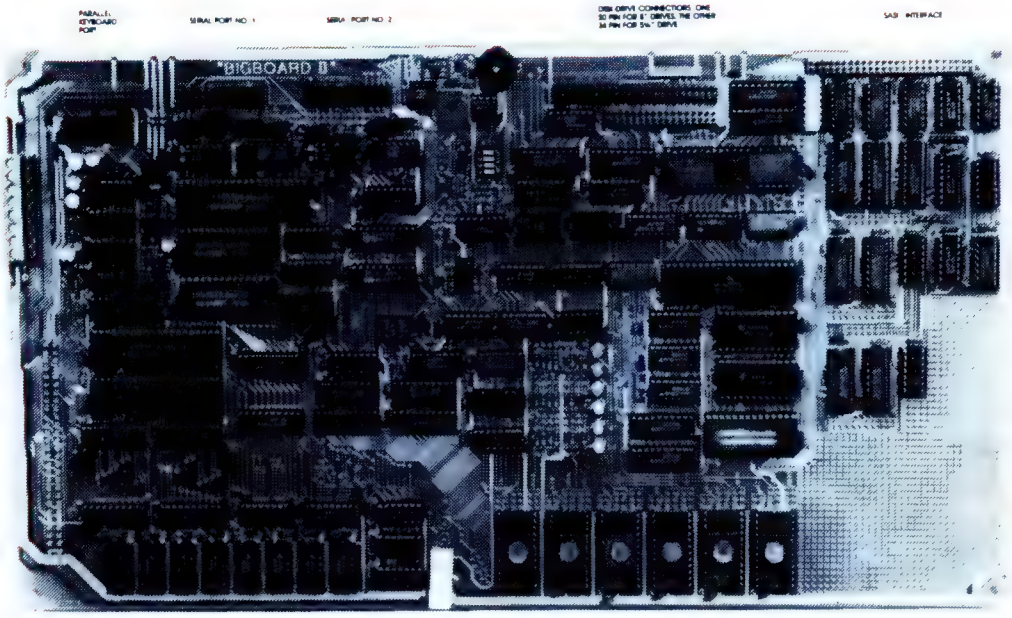
48–50 A'BECKETT STREET MELBOURNE (03) 347-9251

"BIG BOARD II"



STD Bus Connector

EPROMs shown only for clarity.

Prototyping Area

Jim Ferguson, the designer of the "Big Board" distributed by Digital Research: Computers, has produced a stunning new computer that we will begin shipping in November called "Big Board II", it has the following features:

4 MHz Z80 — CPU AND PERIPHERAL CHIPS

The Ferguson computer runs at 4 MHz. Its monitor code is lean, uses Mode 2 interrupts, and makes good use of the Z80-A DMA chip

64K DYNAMIC RAM + 4K STATIC CRT RAM + 24K E(E)PROM OR STATIC RAM

"Big Board II" has the three memory banks. The first memory bank has eight 4164 RAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two 2Kx8 SRAMs for the memory-mapped CRT display and space for six 2732 As, 2Kx8 staticRAMS, or pin-compatible E(E)PROMs. The third memory bank is for RAM or ROM added to the board via the STD bus. Whether bought as a bare board, a full kit, Or assembled and tested, it comes with a 450nS2732 EPROM containing the monitor

MULIPLE-DENSITY CONTROLLER FOR SS/DS FLOPPY DISKS

The new Ferguson single board computer has a multiple density disk controller. It can use 1793, 1797, or 8877 controller chips since it generated the signal with TTL parts. The board has two connectors for disk signal with 34 pins for 5 25" drivers, the other with 50 pins 8" drives

VASTLY IMPROVED CRT DISPLAY

The new Ferguson SBC uses a 6845 CRT controller and 8002 Video Attributed controller to produce a display that will rival the display of quality terminals. Characters are formed by a 5x7 dot matrix on 15.75 KHz monitors and 7x9 dot matrix on 18 60 KHz monitors. The display is user programmable with the default display 24 lines of 80 characters. 8002a chip supplied for 18 to 60 kHz monitors

STD BUS CONNECTOR

The Ferguson computer brings its bus signals to a convenient place on the PC board where users can solder an DSTD, bus cards can be plugged directly into it, and it can as well be connected by bus cable to industry-standard card cages

DMA

The new Ferguson computer has a Z80 A DMA chip that will allow byte wise data transfers at 500K bytes per second and bit serial transfers via the Z80 A S10 at 880K bytes per second with serial processor overhead, though the monitor for the new computer uses the DMA chip mainly for transferring data to and from disk, the chip can readily be used for other things since its "wait/ready" pin can be connected under software control to some half a dozen signal lines. When a hard disk subsystem is connected to the "Big Board II" via its "SASI" interface, the DMA chip makes breathtaking disk performance possible

"SASI" INTERFACE FOR WINCHESTER DISKS

The "Big Board II" implements the Host portion of the "Shugart Associates Systems Interface". Adding a Winchester disk drive is no harder than attaching a floppy-disk drive. A user simply 1: Runs a 50-conductor ribbon cable from a header on the board to any of several inexpensive controller cards for Winchester drives that implement the controller portion of the SASI interface. 2: Cables the controller to an appropriate drive, and 3: Provides power for the controller-card and drive. Since our CBIOS contains code for communication with hard-disk, that's all a user has to do to add a Winchester to a system!

A Z80-A S10/0 = TWO ASYNCHRONOUS/SYNCHRONOUS SERIAL PORTS
A PARALLEL KEYBOARD PORT = FOUR OTHER PARALLEL PORTS USER 1/0

The new Ferguson single-board computer has one parallel port for an ASCII keyboard and four others for user defined 1/0. When the computer is powered-up or reset, the monitor looks for a carriage-return at the keyuboard and serial ports. If the first carriage-return the monitor gets comes from the parallel keyboard, the monitor uses the board's video display circuitry to communicate with the user via a CRT. If the first carriage-return is typed at an ASCII terminal attached to a serial port, the monitor autabauds and makes the terminal the system console

TWO Z80-A CTCs = EIGHT PROGRAMMABLE COUNTERS/TIMERS

The new Ferguson computer has two Z80-A CTCs. One is used to clock data into and out of the Z80-A S10/0, while the other is for systems and application use

PROM PROGRAMMING CIRCUITRY AND SOFTWARE

The new Ferguson SBC has circuitry and drivers for programming 2716s, 2732(A)s, or pin compatible (E)EPROMs. Software $25 extra

CP/M

C P M with Russell Smith's CBIOS for the new Ferguson computer is available for $220
The CBIOS is available separately for $65
At full board size 39 6cm x 22 2cm 5 inch BIOS being developed Approx price $95

Pricing and Availability

Available ex-stock

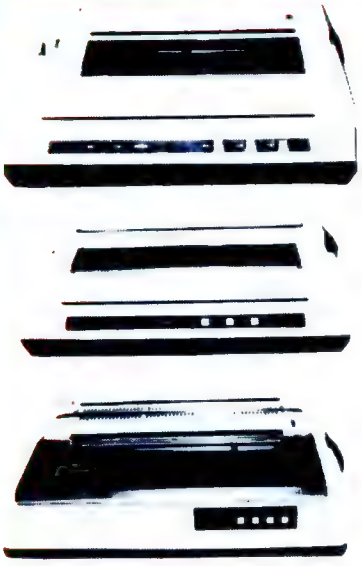
In single quantities, full kits cost $695 inc. tax , and A&T'd computers cost $895. There are attractive discounts that range to 35% for OEM's and dealers. For details about them please call Rod Irving on (03) 489 7099. ie: 3 Ferguson II "Big Board" are less 20% off the one-off price, hard disks disk controllers, boxes and power supply to suit both 8" & 5¼" systems will be available

Bare board with main chips now available (includes PCB, Manual, PALS, Monitor ROM, SMC chips). You have to add rest of components at $395 + tax

Error and omissions excepted

C. Itoh PRINTERS

FROM ROD IRVING ELECTRONICS



Pro/Writer Printer 8510

Print Features: Number of columns—136 col. max. Print Speed—120 CPS. Print Direction—Single-directional and Bidirectional, Switch Selectable. Throughput Speed—From 44 to 152 lpm. Character spacing (max. number of columns per line)—Pica 10 CPI (80), Double Width 5 CPI (40), Compressed Font 17 CPI (136), Double Width 8.5 CPI (68), Elite 12 CPI (96), Double Width 6 CPI (48), Proportional, Double Width Proportional. Line Spacing—Variable to 1/144". Print Width—203 mm (8") max.
Forms Type: Fan Fold Roll or Cut Sheet: Width—113 mm to 254 mm (4.5" to 10.0"). Total Thickness—0.06 to 0.28 mm (0.002" to 0.011"). Number of Copies—Original + 3 copies nominal.
Form Feed: Method—Tractor or Friction. Form Loading—Either rear or top.
Interface—Serial: Method—EIA RS232-C and 20mA (40 & 60mA switchable option) Current Loop Serial Interface. Baud Rate (BPS)—110, 300, 600, 1200, 2400, 4800, 9600. Transmitting Method—Half Duplex. Synchronization—Asynchronous.
Interface—Parallel: Method—TTL compatible, 7-bit, parallel interface. Control Signals—ACK, BUSY, SELECT, DATA STB, INPUT PRIME, FAULT, INPUT BUSY, PAPER EMPTY. Instruction Codes—(ASCII): CR, LF, VT, FF, CAN, SO, SI, DEL, DC1, DC2, DC3, DC4, GS, RS, US, FS, EM. GRAPHIC SYMBOLS. BIT GRAPHICS.
Error Detection: (1) Parity (VRC)—Odd, Even, No-parity. Switch selectable. (2) Framing Error—Stop bit check. (3) Overrun Error—Error is detected when data are received before the previous data have been processed.
Physical dimensions: 396 mm W x 120 mm H x 285 mm D (15.7" W x 4.7" H x 11.2" D).
Weight: 8.5 kg (18 lbs. 12 oz.)

Model 1550

The Model 1550 is a compact desk-top dot matrix serial impact printer used for data communication terminals, hardcopy of CRT displays, peripheral terminals for minicomputers and microcomputers, and small-sized business systems.
The character format is a dot matrix of 7(H) x 9(V) or 8(H) x 8(V).
Print speed is 120 characters/second. Up to 136 characters can be printed per line at 10 CPI.
Its main features are • Compact desk-top dot matrix printer • 136-column print • Lightweight • Low power-consumption • High-quality print • Bit image graphics • Graphic Symbols • Prints in six different languages • High reliability • Low cost.

F-10 Printmaster Daisy Wheel Printer

Print Speed: 40 CPS. **Print Method:** Static Print Impact. **Number of Printable Columns:** 136, 163, Variable. **Character Spacing:** 1/120 Inch (minimum). **Line Spacing:** 1-48. **Return Time:** 900 msec. **Line Feed Time** 40 msec. **Paper Width:** 406 mm (maximum). **Print Characters:** 96. **Printwheel:** Industry Standard 96 Character Wheel. **Interface:** Industry Standard 8-bit Parallel, RS232-C Compatible, X-ON, X-OFF, 12-bit Qume and Diablo Compatible. **Dimensions:** 574 mm W x 405 mm d x 153.5 mm H (22.5" W x 15.9" D x 6" H). **Weight:** 14 kg (30.8 lbs.) with cover and power supply. **Noise:** Less than 65 Db (1M from Platen, A Scale).

Special Prices till Nov 30th 1983

tax exempt

P* $795 ($695)
S** $1095 ($945)

P* $995 ($895)
S** $1395 ($1295)

P* $1950 ($1675)
S** $2100 ($1775)

* Parallel Interface ** Serial Interface

ERRORS AND OMISSIONS EXCEPTED

NEW VIDEO MONITORS

Get a clear honest image!

Computer data and graphic displays never looked better, brighter, sharper.

High Resolution

- Recommended Display Characters: 1920 (80x24).

GUARANTEED for 12 months by Rod Irving

SCHOOL AND CLUB BULK BUYS
Please ring for pricing

- High quality, non-glare CRT
- Compact and Lightweight with all Controls Inside Front Panel
- All units 100% Factory Burned-In
- 800 lines centre resolution
- Suitable for Apple* — and other computers (Apple is a registered trademark of Apple Computer Computer, Inc.)
- Green or Orange Phosphor available
- 18 MHZ
- First Shipment arriving middle of June 1983
- Direct Import Price for June

Green Phosphor $179 ($152 Exempt)
Orange Phosphor $199 ($159 Exempt)

GREAT VALUE

THE PRINTER PEOPLE'S SPECIALS

Just Arrived

A NEW PRINTER NOW!

CP-80/I, 80-COLUMN IMPACT PRINTER

SPECIFICATIONS

Functional Specifications

Printing method — Serial impact dot matrix.
Printing format — Alpha numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 7 x 8 dot matrix. Bit image graphic — Vertical 8 dots parallel horizontal 640 dots serial/line.
Character size — 2.1mm (0.083") W x 2.4mm (0.09") H, 7 x 8 dot matrix.
Character set — 228 ASCII characters. Normal and italic alpha-numeric fonts, symbols and semi-graphics.
Printing speed — 80 CPS, 640 dots line per second.
Line feed time — Approximately 200 msec at 4.23mm (1/6") line feed.
Printing direction — Normal — Bidirectional logic seeking. Superscript and bit image graphics — Unidirectional left to right.
Dot graphics intensity — Normal — 640 dots/190.5mm (7.5") line horizontal. Compressed characters — 1,280 dots/190mm (7.5") line horizontal.
Line spacing — Normal — 4.23mm (1/6"). Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216").
Columns/line — Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed/double width — 71 columns. The aboves can be mixed in a line.
Paper feed — Adjustable sprocket feed and friction feed.
Paper type — Fanfold, Single sheet. Thickness — 0.05mm (0.002") to 0.25mm (0.01"). Paper width — 101.6mm (4") to 254mm (10").
Number of copies — Original plus 3 copies by normal thickness paper.

Mechanical Specifications

Ribbon — Cartridge ribbon (exclusive use) black.
MTBF — 5 million lines (excluding print head life).
Print head life — Approximately 30 million characters (replaceable).
Dimensions — 377mm (14.8") W x 295mm (11.6") D x 125mm (4.9") H incl. sprocket cover.

Parallel CP80 $479 ($410 exempt)
Serial CP80 $595 ($515 exempt)

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NOW OPEN AT 48-50 A'BECKETT STREET, MELBOURNE (03) 347 9251

TO ORDER: Heavy items sent Skyroad Freight on Mail Order. Phone 481-1436. Wholesale Customers Phone 489-7099. Mail Orders to RITRONICS WHOLESALE, P.O. Box 235, Northcote 3070.
Minimum P&P $2. Add extra for heavy items, registration and certified mail.
Prices and specifications subject to change without notice.

Bankcard mail orders

ORDER FORM

Please Debit my Bankcard

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Expiry Date.....

Name.....

Signature.....

Micronews

Kits for S-100 bus

Rod Irving Electronics now has available S-100 boards and kits from Research and Scientific Engineering, and Australian company producing a range of economical computer hardware.

First off the rank is the RASE80 CPU board, which provides a 4MHz Z80, battery-backed real-time clock/calendar, 2K of CMOS RAM, space for up to 16K of EPROM, two RS-232C serial ports, three 8-bit parallel ports and a Centronics-compatible parallel printer interface. The on-board memory can be disabled to allow the use of a full 64K in an expanded system.

We had a chance to examine the bare board and manual and were impressed both by the quality of the double-sided, plated-through board and the extensive documentation. At $295 plus tax for a complete kit, or $350 assembled and tested the RASE80 board seems like very good value.

Complementing the CPU board is the RASEFDC, an S-100 floppy disk controller board based on the Western Digital WD1795 double density controller chip. Any mixture of 13cm and 20cm double-sided and single-sided disk drives can be used with the board, and again the quality of the board and documentation is first class.

With either CP/M or MP/M the RASEFDC and RASE80 CPU boards are fully supported with boot BIOS and XBIOS routines and a full assembly language listing of the required software is provided. Price for the floppy disk controller board is $295 for the kit and $350 assembled and tested (all prices are plus sales tax).

Bare boards for both the processor and floppy disk controller are available at $180 and $150 respectively. Manuals for both boards can be purchased separately for $15 and $12.

Additional boards are under development, including a 256K dynamic RAM board, a video controller, hard disk controller and an input/output board.

Rod Irving also has available a range of disk drives and disk drive cases, including single and dual cabinets for 13cm and 20cm drives, with or without in-built power supplies. Fabricated from black enamelled steel plate, the cases for 13cm drives are available for $39 (single) and $59 (dual drives) or $79 and $99 with power supply.

For further information on the RASE boards or the disk drive cabinets contact Rod Irving Electronics, 425 High Street, Northcote, Vic, 3070. Phone (03) 489 8131.

Big expansion of Atari range

Futuretronics Australia Pty Ltd, exclusive Australian distributors of the Atari range of computers and video games, introduced the new Atari XL range of computers, peripherals and software at the Melbourne Home Show.

The new Atari line-up includes more than 35 new products, including the Atari 600XL home computer (16K RAM) and the Atari 800XL machine with 64K of RAM, a new line of printers and a CP/M module to allow this operating system to be used with the 600 and 800XK 800XL machines.

Also announced is a "Touch Tablet Controller" which enables the user to paint pictures, draw diagrams and write text using the touch of a finger or a stylus. Remote control wireless joysticks, a light pen and a track ball controller also feature in the new range.

Software for the new computer sytems already includes some 2000 programs for the 800XL and 1500 for the 600XL, one of the largest ranges available for any machine on the market. New releases include Atari Logo, new games based on Walt Disney productions and Atariwriter, a full screen word processing system.

Joint managing directors of Futuretronics Australia Pty Ltd, Harry Chojna and Peter Alpar said at the introduction of the new Atari products, "Our objective is to capture the major share of the Australian home computer market. We now have the products to do this and we know that Atari will be a force to be reckoned with. They are the best in the world today and no one competing against us can make such a product offering. It is a commitment by Atari and Futuretronics Australia Pty Ltd to deliver to the marketplace the products that are needed".

For further information on Atari products contact Futuretronics Australia Pty Ltd, 1076 Centre Rd, Oakleigh, Vic 3166. Phone (03) 579 2011.

DICK'S GOT TWO NEW ONES!

PRICE BREAKTHROUGH

Compact Four Colour Printer/Plotter at only $299

Unbelievable! Now every computer user can afford a high resolution 4 colour printer/plotter. Yes, this remarkable plotter can not only print text in four bright colours, it can produce designs, pie or bar charts....even maps!

Yet it is amazingly simple—with four ball point pen elements, print medium replacement is easy and economical—and avoids many of the problems that occur with more complicated types.

Look at these amazing features:

- Suits all standard Centronics-type computer interfaces.
- Uses non-coated (economical!) standard paper (114mm wide rolls).
- All operations (colour, type size, graphics/text, etc) software controlled under simple BASIC 'LPRINT' statements.
- Minute 0.2mm resolution and minimum step size
- Standard 96 ASCII character set
- 10 characters per second printing speed

Cat X-3245

AMAZING VALUE!

NOW

A low cost dot matrix printer that's quick and quiet

Everything about this outstanding new BX-80 printer from Dick Smith Electronics says 'quality'! A super-fast print speed of 80 characters per second, the latest patented technology of 'in-line' print needles....the BX-80 has all the features you want and need. And to add to the already-impressive list, this superb unit is amazingly quiet in operation!

Yes! The BX-80 will produce excellent graphics. And yes—it operates via normal software control. Combine it with virtually any computer which uses a standard Centronics printer interface! And by the way—an excellent manual, complete with program samples, is provided! What value!

Features:

- 40 column (double width) to 142 columns per line
- Fan form (sprocketed) or friction feed (single sheet) stationery.
- Proportional and bold face printing, plus super-scripting and sub-scripting
- Very easy to move around—it weighs just 5.3kgs!
- Head life quoted at an amazing 30 million characters!
- Outstanding value for money!

Cat X-3268

for only

$649

COMPARE OUR PRICE!

SAME VALUE FOR ACCESSORIES

Paper Rolls To suit X-3245 printer. Quality! Cat X-3246. $6.50

Pen Sets Replacements for the X-3245. Cat X-3247. $7.50 EA

Fan-form Paper To suit X-3268 2000 sheets. Cat X-1189 $36.50

The Computer Specialist

DICK SMITH Electronics

See page 120 for address details

A620/TH

FASTER, FASTER FOR GOODNESS SAKE, FASTER ...

AED RELEASES PSEUDO DISK FOR "UNIVERSE" AND OTHER S100 SYSTEMS

In this column over the last five months we have examined the various features and innovations of the AED UNIVERSE S100 microcomputer system. This month sees the end of this mini series, however, up to date information will be published from time to time in the electronic press.

In response to the ever increasing demand for more speed from single-user and in particular multi-user computer systems, AED have released a high speed silicon memory drive device for almost any S100 computer system including the AED UNIVERSE supercomputer II.

The AED pseudo disk offers greater storage capacity than the original U.S device referred to as SEMIDISK and comes with a considerably more economical price tag. The device is I/O driven and requires no hand-shaking during both read and write operations, and therefore runs at a very high speed. Performance is even faster with advanced processors using block I/O transfer capability (ie Z80, 8088, 8086, 80186, 80286, 16032, etc). The actual speeds achievable are up to 4 times the data transfer rate of 8" double density floppy drives (8 times that of 5.25" inch drives) with zero seek time, no head load time, and no latency. In practice the device responds at lightning speed compared to floppy and hard disk counterparts. The pseudo disk I/O approach has proven to be considerably faster than the Godbout COMPUPRO equivalent referred to as MDRIVE and is also less expensive (BRAVO AUSTRALIS).

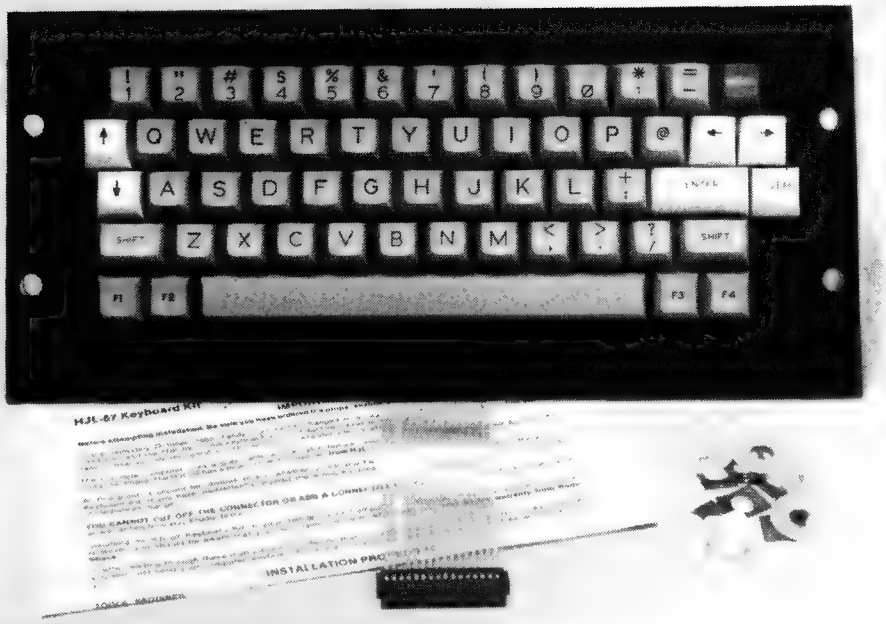
The device is referred to by AED as UNDISK and is ideal for applications that require considerable disk I/O such as compiling programmes, much referenced data files, disk based sorts, and in particular multi-user and network systems where multiple disk accessing are the norm and speed is the order of the day.

The simple I/O driven nature of the card makes it compatible with almost all S100 systems (even poorly designed ones). The UNDISK totally complies to the IEEE 696 S100 specification as do all S100 products manufactured by AED.

To make installation easy AED supplies a special programme that loads itself above your CP/M operating system and automatically links itself into the CP/M bios jump table to install the necessary routines. The drive is then simply accessed as CP/M drive "M".

Micronews

Keyboard enhancement for Color Computer



Paris Radio Electronics now has available a "drop-in" replacement keyboard for the Tandy TRS-80 Colour Computer. The new keyboard is easily installed on the existing mounting posts and simply plugs into the keyboard connector but provides full-size, full stroke typewriter keys to replace Tandy's pushbutton style keyboard.

Key lay-out and colour scheme is identical to that of the original Colour Computer keyboard.

All mounting hardware is provided with the keyboard, including a face plate to match the finish of the Colour Computer. Be aware however that installation of the new keyboard requires opening the case of the computer, which voids any Tandy warranty on the system.

For further information on the new keyboard plus a range of software and magazines for the Colour Computer contact Paris Radio Electronics, Shop 1, 165 Bunnerong Rd, Kingsford, NSW, 2032. The postal address is PO Box 380, Darlinghurst, NSW, 2010. Phone (02) 344 9111.

Texas Instruments drops prices, introduces more software

Texas Instruments has announced significant price reductions on its range of TI-99/4A computer peripherals. Biggest reduction is on the disk controller board, reduced from $199 to $100. Disk drives, currently selling at $499, have been reduced by 18%.

Other peripherals subject to price reductions are the peripheral expansion box (one-third off), 32K memory expansion board (also one-third off) and the RS232 interface board.

"The new peripheral prices make the more sophisticated software such as Microsoft Multiplan and TI Writer more affordable and attractive for home users," according to Claudio Ellero, marketing manager for TI's consumer group. "With the new one year warranty and low peripheral prices the 99/4A is the most competitive home computer on the market today," says Claudio.

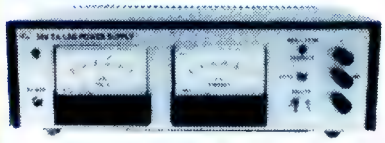
Putting substance into TI's intensive marketing promotion of the TI-99/4A is the announcement that Texas Instruments has produced 52 educational program cartridges for the machine, covering a wide variety of subjects and levels.

Educational software for the 99/4A also includes PLATO courseware on disks. Texas Instruments has the exclusive distribution rights from Control Data Corporation for distribution of the PLATO basic and high school skills learning series.

ROD IRVING ELECTRONICS

425 HIGH ST, NORTHCOTE 3070 VIC PHONE (03) 489 8131

50V 5A LABORATORY POWER SUPPLY



New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.
EA May, June 1983

$140.00

OVERLOAD INDICATOR

Will detect even slight overload conditions and is not affected by load impedance or varying supply voltages. **E.A. JUNE '83**

$75.00 EFFECTS UNIT

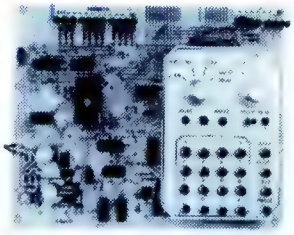
An "Effects Unit" that can create phasing, flanging, echo, reverb and vibrato effects. **E.A. JUNE '83**

EPROM PROGRAMMER

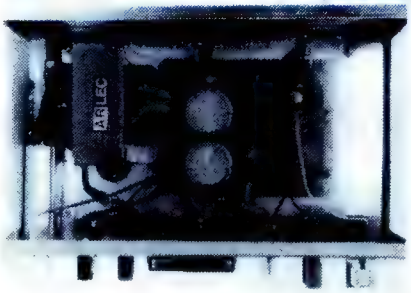
$43.00

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.

With Textool Sockets $55.00
EA January 82



DUAL TRACKING POWER SUPPLY $83.50



Built around positive and negative 3-Terminal Regulators, this versatile dual tracking Power Supply can provide voltages from ±1.3V to ±22V at currents up to 2A. In addition, the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway **EA March 82**

SOUND TRIGGERED FLAS $26.50

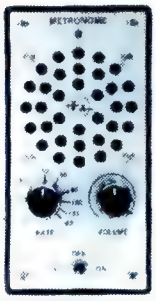
This easy to build sound or light operated flash trigger has many feature.

Catch those spectacular and humorous moments like that time your mother-in-law slipped on the moss covered patio and broke her neck. **ETI 568 October 80**

ELECTRONIC METRONOME

$18.90

Great new Metronome Circuit with low current drain (less than one milliamp) drives a Loudspeaker and a Led Indicator. **EA January 82**



"LE GONG"

$14.95

The "Le Gong" Doorbell with those unmistakable chimes generated by the LSI. A must for the man who has everything! **EA February 81**

VOICE OPERATED RELAY

$14.95

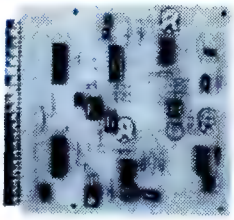
EA's great new Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter, or to control a slide projector. **EA April 82**

3½ DIGIT LCD CAPACITANCE METER

Handy pocket size Digital Capacitance Meter, runs off a 9V battery and measure 1pF to 19.99uF in just three ranges **EA March 82**

LED LEVEL METER

$27.00



Build a Led level Meter with simultaneous peak and average display plus 60dB dynamic range. This kit is ideal for any application requiring a wide dynamic range level display **ETI 458 June 81**

FUNCTION GENERATOR $79.50

This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160kHz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting. **EA April 82**

DIGITAL THERMOMETER: 3½ DIGIT LCD

$79.00

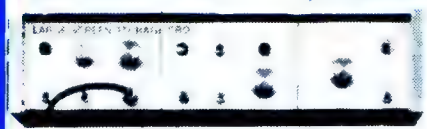
Measure temperatures from below freezing point to around boiling point. **EA February 82**

LOTTO/POOL'S SELECTOR

$22.50

You have to be in it to win it . . . Take the chance out of winning the Pools as well as Lotto, and build the great new Pools/Lotto Number Selector. **EA July 81**

LARGE SCREEN TV STORAGE CRO ADAPTER $119.00



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Micronews

"Compumate" adds intelligence to Atari video games machine

Videoactive Electronics, Australian distributors of Spectravision Atari-compatible video game cartridges and the new Spectravideo SV318 and SV328 personal computers, has released an add-on keyboard for the Atari 2600 games machine.

The "Compumate" add-on keyboard transforms the 2600 into a computer, adding 16K of built-in Read Only Memory, 2K of programmable memory, a Basic interpreter and a 42-key flat membrane-switch keyboard. A cassette interface is included in the keyboard, allowing a standard audio cassette recorder to be used for storing programs.

Also provided by the add-on is a two channel sound generator with a range of two octaves and a "magic easel" program that allows the user to create pictures and graphics in up to ten colours.

Software will be available on cassettes for the system, with six titles released so far, including typing and maths tutoring programs, graphics and an educational game.

For further information contact Videoactive Electronics, 70 St Kilda Rd, St Kilda, Vic. 3182. Phone (03) 537 2000.

Magazines for MC-10, portables

Users of the Tandy MC-10 computer will be pleased to know that an Australian version of "MiCo" magazine is now available. The first issue runs to 62 pages and includes technical details, programs and comparisons with the TRS-80 Color Computer. (It turns out that the MC-10 can run many of the programs written for the Color Computer.)

Also available from Greg Wilson is "MiCo Exposed", an annotated disassembly of the Microsoft Basic of the MC-10. The assembly language listing of the interpreter is accompanied by detailed comments and a wealth of other useful information for the dedicated programmer.

TRS-80 Color Computer users should also be aware of "Australasian Rainbow", with news, programs and articles of interest for the Color Computer. Details of all publications are available from Greg Wilson, PO Box 9, Potts Point, NSW, 2011.

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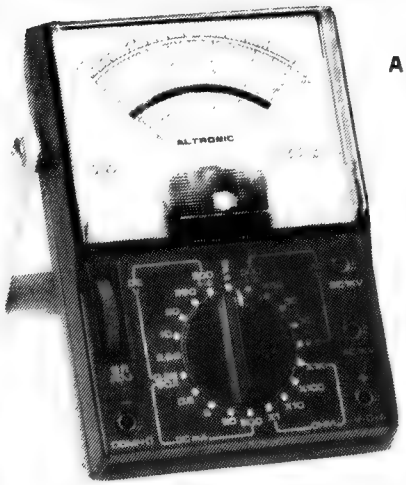
Jack O'Donnell



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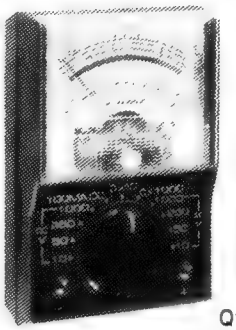

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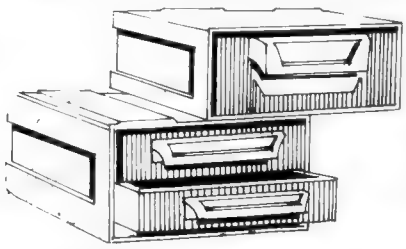

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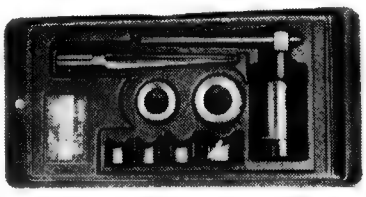

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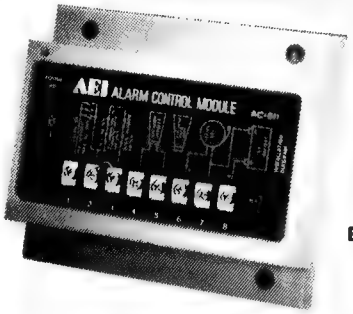

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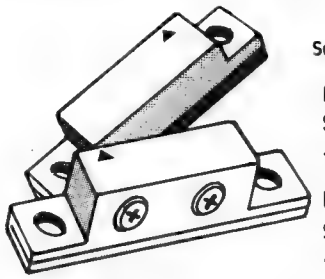

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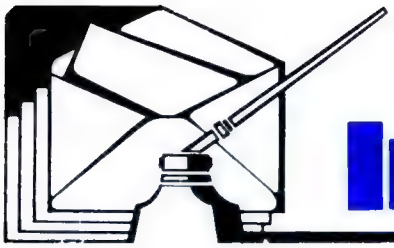

Information centre

TRIP METER: As an off and on reader of your magazine over the past few years, I wonder if you can help me with a design or an already existing design for something I wish to build.

I am a student at Swinburne and although I am majoring in accounting and data processing I have kept up a relationship with hobby electronics – I am able to successfully construct kits and circuit designs up to the moderately difficult level and am able to modify some simpler circuits to suit my own needs. But I am yet to find (given reasonably limited resources) anything near what I need.

What I am after is this: There exists a device (called a "Halda") which is a combined odometer/trip meter incremented in 100ths of a kilometre. This is used for navigation as route instructions are given in so many 100ths of a kilometre in such a direction.

Now being a student with big ideas of dabbling in rallying I can't afford $400-$500 for a new one or even $200-$300 for a serviceable second-hand one. So what I'm after is a design for an electronic version of the same but the closest thing I can find is the economy gauge mentioned (so I'm told by word of mouth) in an EA sometime last year.

I assume it worked on the principle of using a reed switch to record two impulses per turn of the tailshaft, dividing that number again by the ratio (3.89:1), dividing that result by how many times the circumference of the wheels (207.3cm) is divided in a kilometre (483.092) times.

Now assuming you could work out the distance travelled, could you not stop there and display that cumulative amount with the option of resetting it at any point? I personally don't know enough about electronic design to solve that but I know that myself and many others (not only at Swinny) would appreciate an easy-to-build project along these lines.

● There are two ways in which such a project could be obtained. One way would be to modify our Car Computer project which was described in "Electronics Australia" from July to September 1982, or two, use the event counter described in July 1983 together with a suitable interface for the distance sensor.

We are unable to undertake these modifications at the moment but we shall publish your letter in the information pages and see if reader interest justifies such a project.

WIZZARD: First I would like to express my appreciation for a really great magazine; it is consistently both informative and interesting and one looks forward each month to receiving it.

Recently I purchased a Dick Smith Wizzard computer as a low cost way of being introduced to computers (admittedly to play games). I now find that Dick Smith will not be fully supporting this machine with software but only periodically with games cartridges.

In American magazines I have seen advertisements for "cartridge adapters" enabling, for example, VIC 20 machines to use Atari cartridges. The Wizzard also uses a 6502 microprocessor so I assume that a cartridge adapter would also be possible. Could you maybe run an article on such an item? Dick Smith in his recent advertisement has claimed that sales of this unit have reached 12,000 so surely such an article would have a wide appeal.

You might also consider a review of the machine as well.

I trust that my suggestion will at least receive some consideration as I realise that a magazine such as yours has quite a lot to cover but the future is definitely leaning towards computerisation and "games" are a major part of computers. (P.M., Lakemba, NSW).

● Simply to say that two computers use the same microprocessor does not guarantee that the same software can be run on both machines, even if the hardware incompatibilities can be overcome by a cartridge adapter. There would also be differences in the size and configuration of memory and in the control of the video display and sound generator to be considered.

Feedback on the EPROM Programmer

EPROM PROGRAMMER TRAP: In your Information Centre of September 1983, R.I., of Jindalee Qld, told of his EPROM Programmer (described in EA January 1982) which "blows up" chips. In response, you suggested to him some obvious areas of possible trouble.

It would seem that this problem may be common as I had an identical problem. The programmer destroyed both National and Hitachi 2716s when the S3 (program-ready, +25V) switch was operated. A check of all signals showed the levels to be OK and the timing to be correct. The +25V line was stable.

Closer inspection showed that throwing S3 generated a narrow spike on the OE line of the 2716. The spike went up to about +6.7V (exceeding the absolute maximum rating). By isolating pin 20 of the 2716 from pin 8 of IC9d which drives it, it was determined that the spike was not generated by IC9d, but was being induced into the interconnecting line.

The track feeding OE, pin 20, runs parallel for a considerable distance to the track feeding +25V to Vpp, pin 21. By cutting the track at OE, pin 20, and at pin 8 of IC9d and reconnecting them directly via a length of wire the level of the spike was considerably reduced.

Then I replaced all aluminium electrolytic capacitors with tantalum types. With these two modifications completed, the programmer produced correctly programmed EPROMs rather than consistently dead EPROMs.

Another modification considered worthwhile is to increase the value of the .01μF capacitor connected to the program switch to 0.1μF. The switches supplied were not high quality, with considerable contact bounce on releasing the depressed switch. This resulted in a second 50 millisecond pulse being generated on switch release, and could result in chip damage (though not the cause of the problem of dead chips as discussed above).

The increased capacitor value eliminates the switch bounce problem. (S.C., Carine WA).

We do not have sufficient information on the Wizzard to say whether such an adaptation is possible. In most cases the simpler solution is to write a program from scratch for a particular machine.

However, perhaps other users of the Wizzard are in a better position to consider your suggestion, and we would welcome contributions along the lines you suggest.

The Wizzard games machine was reviewed in our October 1982 issue.

PLAYMASTER 114: I have in my possession, in perfect working order, a Playmaster 114 program source, bought a number of years ago by my father (see EA Oct. 1965 and Sept. 1966). After pulling it, dusty from an attic, I now have it running; however, having grown up after the "valve era", I have trouble interpreting the circuit, so I hope you can assist me.

Firstly, can you tell me briefly how this receiver compares with modern ones, say the DX-100? Similar sensitivity? What? Would the digital readout for shortwave receivers be compatible with the 114, and if so, where exactly on the local oscillator should I connect it; and in the 114 is the local oscillator frequency 455kHz higher than the tuned signal frequency, as the article in Sept 1966 doesn't say, If not, can you tell me what it is?

I know turning the clock back this far may be a tall order, but I hope you can help me. (J.V., Wahroonga, NSW).

● We have not performed comparison tests on either the Playmaster 114 tuner or the Realistic DX-100 but we would assume that both receiver designs would have roughly the same order of sensitivity. As far as bandwidth is concerned, the Playmaster tuner could be expected to have a wider bandwidth than the later solid state DX-100 and the distortion of both designs would probably be on a par.

The local oscillator in the Playmaster 114 followed normal practice in being 455kHz above the tuned frequency. The most likely usable point of connection for the frequency readout circuitry would be to the triode grid of the 6AE8 via a small capacitor of say 10pF.

DWELL EXTENDER: I have some queries about electronic ignition systems that I would like answered, if possible, through your Information Centre.

Firstly, congratulations on a fine magazine, one which I have been reading for about 15 years. Being both an electronics and car enthusiast I have followed with interest the development of electronic ignition systems.

I have constructed the dwell extender featured in the February 1970 edition and although it works once the motor is running, I cannot get the motor started using it. I have also built the August 1970 CDI, eventually modifying it to your April 1978 circuit incorporting a tachometer drive, and more recently your TAI system, eventually modifying it to MKII specifications. My "hotted" sports car seems to give better performance using the CDI system, possibly due to fouled plugs.

In various journals I have seen advertisements for "reactive discharge ignition" systems originating from the UK. These units reportedly have all the advantages of both systems.

There are also CDI circuits around with an inductor in series with the SCR anode (presumably to extend the spark time). I have also read of a rectifier being installed across the ignition coil primary with the same intention. Whilst I appreciate that you dislike commenting on other than your own circuits, I am confused and any comments would be apppreciated.

A large Australian company has been advertising a Hall Effect unit to replace the contact points. The advertisement says to watch your magazine for details of TAI conversion. Can you tell me when these details are to be published? (R.P., Adelaide, SA).

● Your last question, regarding the Hall Effect unit to replace contact points, is answered in this issue on page 42. As far as "reactive discharge" ignition systems are concerned they are merely a transistorised ignition system with a fancy name. Sometimes they are also referred to as "inductive discharge" systems, to differentiate them from capacitor discharge systems.

The likely reason for having an inductor in series with the anode of the SCR in CDI designs is to avoid the possibility of dv/dt switching when the inverter restarts and applies voltage to the SCR. The diode across the coil in some designs may have been included to bypass the coil impedance during the charging of the storage capacitor and thus reduce charging time.

We can only speculate as to why the dwell extender will not allow your car to start. Possibly the dwell time constant of the circuit is too short and will not allow sufficient spark duration to enable starting to occur. Thanks for the favourable comments on the magazine.

SUB-WOOFER ENCLOSURE: I followed with much interest your articles on designing sub-woofer enclosures in 1981 and '82 and have recently purchased the kit offered by Jaycar Pty Ltd without the enclosure. It is concerning enclosure design that I have written to you.

My application calls for an enclosure with restricted depth. This would mean that there would be insufficient distance to accommodate the 72mm vent as suggested in the enclosure design, with the appropriate clearance behind it (>1 x diameter). According to Brian Davies' article on this subject, published in your journal, reducing the length of tube by reducing the diameter of the port may increase air turbulence effects.

For my application, then, I see three possibilities of overcoming this problem:

1. Split the tube into two shorter lengths.
2. Bend the tube through 90°.
3. Site the vent in another face.

The first has the attraction that the vent holes can be easily hidden by the normal fabric facing over the speaker baffle board. My question is, is it possible to do this, or is one dependent upon a continuous length for a given diameter

Continued on page 154

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COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

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to achieve the appropriate box tuning? The second choice has a similar advantage but I do not have any design principles on which to work.

The third suggestion poses some other difficulties in relation to siting the box within the area intended. Specifically the port hole will obviously require some clearance on its outer end to clear walls/floor, etc. Would the same requirements as occur on the interior end of the tube (ie ≥ 1 x diameter) also prevail for its outer end? This dimension will obviously control the size of a plinth, should the port be sited in the base of the speaker.

I would be grateful for any assistance or further suggestions you can provide me with and for this I would like to offer my thanks in advance. I have much enjoyed your articles in this series and also on improving the sound quality of electronic organs. I would like to suggest another article in the vein of the latter: practical suggestions on making the accoustically "dead" environment in the home into an acceptably "live" one. (C.L., Glen Waverley, VIC.)

● Any one of your three suggestions could be satisfactory, provided you can actually tune the box to the correct frequency. The easiest course would be to put the vent on another face of the enclosure. We would assume that the outer end of the vent would also have to be unrestricted.

Your suggestion on an article on domestic acoustics is an interesting one although many homes have a different problem in that the listening room is too "live" due to the hard reflecting surfaces of large windows and unadorned floors and walls

RF EXPOSURE: I have come across the terms 0.4W/kg (sometimes 0.4W/kg^{-1}) and 100Wm^{-2} in connections with continuous exposures to radio frequencies in the range 30MHz to 30GHz. This presumably refers to incident radiation absorbed by the body so that 0.4W/kg indicates an absorption of 28W for an average man. I understand that these figures suggest limits to absorption for people exposed to such radiation.

I would be grateful for technical information as to how these figures or limits might relate to actual practice. For example, are there exposure limits set for technicians working in situations where such radiation may apply – in TV broadcasting stations, for example? And, if so, how is the broadcast power (peak output power?) related to the suggested limits stated above.

My query really arose from technicians servicing equipment such as radar installations used in World War II for coastal defence. The power output of equipment used, according to Denis Taylor in "Introduction to Radar and Radar Techniques", was about 200kW (some 1MW) with a frequency of 200MHz and pulse repetition frequency of 1/25 sec. Antennas consisted of an array some 20ft long, consisting of multiple dipoles. According to my informant these antennae were serviced while in operation.

With these powers would technicians have been subject to absorption in excess of the limits above? My informant, in the absence of any measurements of field strength, states that sparks could be drawn from a wire fence some hundreds of yards in front of the antennae. (C.M., Mosman Park, WA)

● We published an article entitled "Microwaves: a health hazard" in the October 1981 issue. This gave safe exposure limits for microwaces of 1mW/cm^2 as the evolving US standard and 10μW/cm^2 as the Russian standard. We have also seen the same figures of 0.4W/kg of body weight quoted in a paper delivered by Arthur W. Guy, PhD, Dept of Rehabilitation, University of Washington. By any standard, the technicians concerned were almost certainly exposed to very dangereous levels of radiation. Photostats of our article are available at $3.00.

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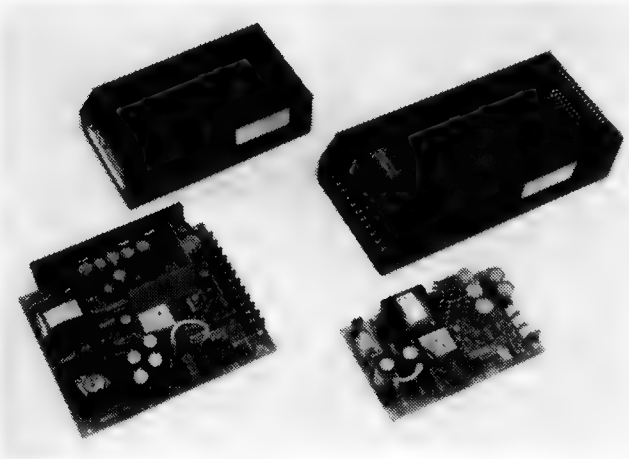

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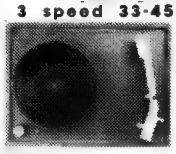

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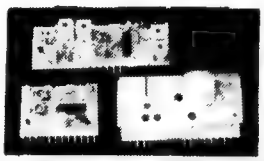

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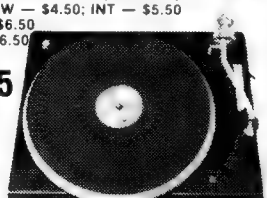

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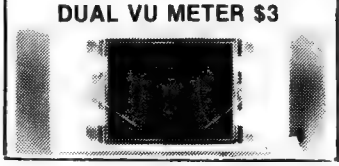

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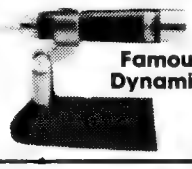

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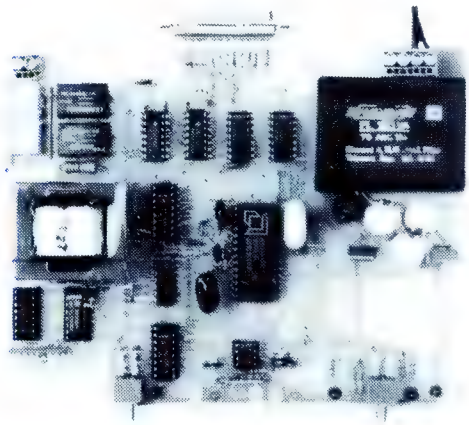

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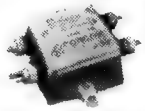

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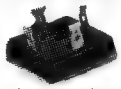

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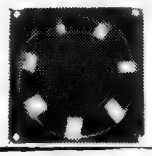

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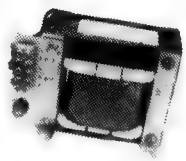

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P-P $1.50

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Have a Happy and Prosperous New Year

WISHING YOU ALL A MERRY CHRISTMAS

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EA Magazine Holders

The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price: $5.10 binders, $4.50 holders.

Mail orders should be sent to Electronics Australia, PO Box 163, Chippendale, NSW 2008.

Prices including postage are:

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EA PC BOARDS AND FRONT PANELS

Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

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Dick Smith Electronics,
125 York Street,
Sydney, 2000.
Telephone 290 3377.
DSE also has branches and resellers throughout Australia.

Jaycar Electronics
117 York Street,
Sydney 2000.
Telephone 29 2098.

115-117 Parramatta Road,
Concord, 2137.
Telephone 745 3077.

Radio Despatch Service,
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Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

VIC.

Rod Irving Electronics,
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Northcote, 3070.
Telephone 489 8131.

48 A'Beckett Street,
Melbourne 3001.
Telephone 347 7917
347 9251.

Kalextronics,
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Heidelberg 3084.
Telephone 743 1011.

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Regional Shopping Centre,
Melton 3338.
Telephone 743 1011.

Sunbury Printed Circuits,
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MacDougal Road,
Sunbury 3429.
Telephone 744 2714

WA

Altronics,
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Perth 6000.
Telephone 328 1599.

Jemal Products,
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Kewdale, 6105
Telephone (09) 451 8726

N.Z.

Marday Services,
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Avondale, Auckland.

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